Development of an Integrated Adaptive and Maladaptive Personality Model for Measuring the Big Five

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DEVELOPMENT OF AN INTEGRATED ADAPTIVE AND MALADAPTIVE PERSONALITY MODEL FOR MEASURING THE BIG FIVE

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ABSTRACT

The structure of the Big Five model of personality was examined when its dimensions were measured independently at both poles, based on new items designed to reduce the social desirability bias often found between the polarities. Inductive, deductive and criterion-centric methods were employed and an instrument created that measures Big Five traits both adaptively and maladaptively.

Based on a comprehensive literature review of the potency of different personality scales in predicting positive and negative performance at work, 410 items were created to measure the desired adaptive and maladaptive scales and a sample of English speaking professionals (N = 1,686 females, mean age = 44.0, SD = 12.0; N = 820 males, mean age = 46.5, SD = 13.0) assessed themselves against them on a Likert scale. Eighteen scales were created based on fifty-seven items and exploratory and confirmatory factor analysis was employed to understand the impact of the new structure on the Big Five. The convergent and divergent validity were tested using hypotheses regarding the proposed correlations with industry benchmark instruments. A re-validation study (N = 438), test re-test study (N = 117), consensual validity study (N = 105) and social desirability study (N = 26, N = 28, N = 40) were also undertaken. Criterion validity was examined using behavioural competency models (N = 254, N = 73), with 360 observer feedback gathered and *a priori* hypotheses tested. The results revealed that evaluative bias can be reduced with the proposed approach, and the Big Five factor structure persists, whilst simultaneously enabling test users to explore their adaptive and maladaptive traits at both ends of the polarities. It is argued that conceptualising maladaptive traits as the more extreme ends of the Big Five ("too much of a good thing") is helpful from a user validity perspective and avoids the risk of pathologizing people in organisational settings.

Finally, the instrument's eighteen scales have been located in the personality periodic table (Woods and Anderson, 2016) and the concept of a blended Conscientiousness and Neuroticism scale has been supported by the current research and provides a new approach. The implications for research and practice are discussed.

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AUTHOR'S DECLARATION

"I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted to any other degree at the University of Westminster or any other institution."

Signed:_____

Stewart Gregor Desson

Date:_____2/10/2017_____

DEFINITIONS OF ABBREVIATIONS AND ACRONYMS

BF57	Big Five Fifty-Seven – the 57-item instrument created in this thesis
CA	Cronbach's Alpha
CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
FFM	Five Factor Model
p.	page
par.	paragraph
PCA	Principal Component Analysis
PLS	Partial Least Squares (Modelling technique)
SEM	Structural Equation Modelling
Sig.	Significance

1 INTRODUCTION

1.1 The Use of Personality Assessment at Work

Research findings on personality have been successfully applied in the field by business psychology practitioners for many decades (Hough & Johnson, 2013). There are two different types of applications that typically use psychometrics, namely selection applications and developmental applications.

Firstly, selection applications typically focus on predicting who is likely to perform well in each role and use this information to make better recruitment and promotion decisions. Anderson and Ones (2003) found the number of these applications increasing in the UK and Europe, with more staff from further down the organisational hierarchy experiencing them.

Secondly, developmental applications typically focus on raising an individual's awareness of their personality and its impact on their performance, so as to help them improve their performance and actualise their potential. "Thus, understanding the interplay between one's personality preferences and one's day-to-day workplace behaviors is critical for designing and implementing effective individual development efforts" (Berr, Church & Waclawski, 2000, p. 134).

However, in the 1960s, 1970s and 1980s, many researchers concluded that the correlations between personality and performance at work were too small to be of practical use in selection or development applications. In his seminal 1968 text, *Personality and Assessment*, Mischel asserted behaviour was inconsistent over time and it was therefore inappropriate to use psychometrics for workplace interventions.

Nevertheless, since the 1960s, a growing body of evidence has been demonstrating the business benefit of both selection and developmental applications of personality models at work with researchers refining models that show criterion validity improving over time (Woods, 2003). In 1995, Mischel updated his 1968 text and reflected that although fundamental questions are still being asked about how to use personality models in the workplace, "the answers-or at least their outlines-now seem to be in sight" (Mischel, 2013, p. xiii).

These improvements are in part due to:

i. The emergence of the unifying Big Five taxonomy enabling researchers to replicate and build on each other's work (O'Connor, 2002).

ii. Further development of measures of lower-order facets of the Big Five which possess improved validities (Paunonen & Ashton, 2001; Bergner, Neubauer & Kreuzthaler, 2010).

iii. Being able to remove lower-order facets with low or even negative criterion validity coefficients from predictive equations and focusing on the most valid facets (Hough, Ones & Viswesvaran, 1998; Hough & Oswald, 2000).

iv. Greater fidelity in measuring the criterion, such as the "Great Eight" competencies (Bartram, 2005), that can be correlated with personality predictor facets based on *a priori* models.

With hindsight, it would seem that both the personality predictor instruments as well as the competency criterion measures available in the 1960s did not have enough fidelity to accurately assess the true validity of the relationships between them. Woods and Anderson (2016) have equated the 1960s use of psychometrics to chemistry in its Nineteenth Century pre-periodic table era.

Modern day psychometrics are now more accurately assessing validities with dynamic models of personality that can draw distinctions between dispositional traits and how they are expressed at work (Saville, MacIver & Kurz, 2009).

Modern day psychometrics are also being designed to demonstrate "user validity", defined as "the overall accuracy and effectiveness of interpretation resulting from the test output." (MacIver, Anderson, Costa & Evers, 2014, p. 155). Research has highlighted that many Big Five models have an evaluative bias (Bäckström, Björklund & Larsson, 2014) that can negatively impact an assessment's user validity (how does the user feel about filling in a questionnaire and reading about aspects of their personality in a personalised report?) and its construct validity (has the construct been measured in a comprehensive and balanced way?).

An example demonstrating the impact on user validity and construct validity would be Extraversion being measured in a socially desirable way ("I enjoy talking to

people") and Introversion being measured in an overplayed way ("I do not speak up in groups"). The consequence is that the positive aspects of, for example Introversion, may not be assessed and a more introverted user may feel undervalued. Equally, the negative aspects of, for example overplaying Extraversion, may also not be assessed. Bäckström et al. (2014) advocate systematically re wording and "neutralising" socially desirable and overplayed item content to eradicate evaluative bias.

By way of contrast, Guenole (2014) refers to the overplaying of traits as "maladaptive" and has called for additional research to more accurately measure them and their potentially negative impact on performance at work. Referring to Guenole's notion of "maladaptive" as "dark side" traits, Gaddis and Foster (2015, p 23) suggest such traits may lead to failed or destructive leadership and implore coaches and psychologists to "monitor and mitigate these tendencies before they become toxic for individual leaders, their organisations, or society."

In the light of the above, it can be seen that the research into improving the effectiveness of personality applications in the workplace is far from complete. Indeed, all the above researchers have suggested further studies are needed to deepen the understanding of the relationship between personality and performance at work. This thesis aims to respond to the various recommendations for further exploration of the Big Five, its facets, its biases and its maladaptive forms, and in so doing, further contribute to the ongoing understanding of Big Five workplace validities.

1.2 Research Purpose

The purpose of this research is to develop an integrated model of personality through use of inductive, deductive and criterion-centric methods (Burisch, 1986) that:

i. Measures both ends of each Big Five factor separately
ii. Measures personality in both adaptive and maladaptive forms

The intention is to create methodologically robust measures that both mitigate the possible bias due to valence in the Big Five and also quantify the impact of adaptive

and maladaptive forms on performance at work. The performance at work criterion is measured through the use of 360-degree feedback on behavioural competencies.

The model aims to integrate the "Big Five personality factors" approach with concepts drawn from Jungian psychology and the latest thinking in the field of personality and competency measurement. This thesis aims to make a contribution to existing knowledge by presenting a psychometric that addresses some of the interrelated limitations of personality assessments such as:

i. A bias for measuring one end of a Big Five factor more positively than the other end
ii. All the facets of a factor being focused positively at one end, rather than some of the facets measuring the construct at the other pole
iii. The potential impact of item valence (the emotional impact of the item on the respondent), item social desirability and item evaluative bias impacting the measures

This thesis also investigates whether the model can be shown to have robust psychometric properties suitable for assessing enablers and blockers to performance at work.

1.3 Key Models and Concepts

A number of key models and concepts are frequently referred to in this thesis. Below is an indication of where to look in this thesis to find full references, background and more information on them. To make the thesis more readable, full references have not been made in this thesis every time one of these key concepts is used.

"Big Five": frequent reference is made to the "Big Five" (Goldberg, 1992; Costa & McCrea, 1992a; Costa & McCrea, 1992b) and use of this term is preferred to the related concept of the "FFM" (Five Factor Model). The history of the Big Five and full references to it are detailed in section 2.2, variants to the Big Five are detailed in 2.3 with details on Big Five validities in section 2.5.

"Bright Side" vs "Dark Side": frequent reference is made to these concepts used in Hogan and Hogan's (1995) HPI "bright side" model and Hogan and Hogan's (1997)

HDS “dark side” model. More background information and references can be found in section 2.9.

“Great Eight”: frequent reference is made to the “Great Eight” (Kurz & Bartram, 2002; Bartram, Baron & Kurz, 2003; Kurz, Bartram & Baron, 2004; Bartram, 2005; Kurz, 2015) competency model. The history of the Great Eight and full references to it are detailed in section 2.11.

1.4 Towards a Balanced Model of Personality

This thesis defines new facets within the Big Five that have been inspired by the balance Jung built into his theory of psychological type (Jung, 1921). This balance in part stemmed from Jung’s desire to reconcile Sigmund Freud’s (Freud, 1912; Freud, 2014) personality theory with that of Alfred Adler’s (Adler, 1917). Despite the fact that Freudians and Adlerians often saw their theories in competition, Jung reportedly valued and used both theories in his therapeutic practice. Jung came to the conclusion that Freud’s theory was influenced by his extraverted nature, and Adler’s by his introverted nature. Jung then sought to create a unifying personality theory that valued and embraced both attitudes, highlighting the need to “rise above the opposition and to create a theory which would do justice not merely to one or the other side, but to both equally.” (Jung, 1966, par. 65).

In his work, *Psychological Types,* Jung (1921) describes Introversion as positively and constructively as he does Extraversion. Interestingly, he also devotes several chapters to the “Type Problem” in human character in which he describes even-handedly both effective behaviours and ineffective behaviours in both Introverted and Extraverted types.

For example, effective extraverted behaviours are described as “open, sociable, jovial, or at least friendly and approachable” (Jung, 1921, p. 330) and ineffective extraverted behaviours include “an exaggerated rapport with persons in the immediate environment and an adjustment to the surrounding conditions that amount to imitation” (p. 336). Effective introverted behaviour is described as “a state of introspection, of contemplation turned inwards to the dream world of internal ideas, and hence a state of Introversion” (p. 144) and ineffective introverted behaviours

include “reserve, secretiveness, lack of sympathy, uncertainty and an apparently groundless embarrassment” (p. 403).

Jung also suggests that “There is no consciousness without discrimination of opposites” (Jung, 1938, par. 178) and that to develop oneself, an individual must integrate opposites within them.

It is the need for balance in an individual that has inspired the design of the explicitly balanced personality model created in this research. This thesis aims to explore how a new Big Five personality model can measure opposites and establish whether this balance helps our understanding of Big Five workplace validities.

1.5 Evaluative Bias in Big Five Models

Mattoon (1985, p. 57) highlighted what could be regarded as a subtle bias, in that Jung’s literature generally discussed Introversion before Extraversion, whereas models created more empirically such as Eysenck and Eysenck’s (1975), typically mentioned Extraversion first. Less subtle bias has been highlighted when these opposites are measured in personality with research highlighting the possibility of an evaluative bias in the measurement of each polarity’s descriptive content (Bäckström et al., 2014). This can occur if one polarity is measured in a more positive or socially desirable way than its opposite. This has also been referred to as positive or negative valence and describes the “intrinsic attractiveness or aversiveness” (Frijda, 1986, p. 7) of the items used to measure each polarity. Other authors have referred to the scoring on an item having a ‘‘substantive’’ and an ‘‘evaluative’’ component (Leising, Scherbaum, Locke & Zimmermann, 2015). McCrae and Costa (1983) use the terminology of “substance” and “style” to describe the same concept. For this research, the terms “descriptive” and “evaluative” have been adopted.

Saucier (1994, p. 141) summarised the issue well when he stated “the typical personality scale involves evaluative as well as descriptive elements; one pole of each scale is typically more desirable than the other pole. Each of the five broadest domains from the language of personality (Goldberg, 1990, 1992; John, 1990; McCrae & Costa, 1985) confounds to some degree descriptive and evaluative elements”. Widiger (1995) in the *‘Mental Measurements Yearbook’* was critical of

the NEO PI-R (Costa & McCrae, 1992a) for not attempting to more strongly mitigate the impact of social desirability bias.

The confounding is more visible in some instruments than others. For example, Pettersson, Mendle, Turkheimer, Horn, Ford, Simms and Clark (2014, p. 434) observed “When an evaluatively unbalanced set of descriptors such as the Big Five adjectival markers (Goldberg, 1992) is subjected to a simple structure rotation algorithm, the resulting factors almost invariably end up contrasting positive versus negative descriptors (Goldberg, 1992).” This thesis has gathered data using one hundred of Goldberg’s (1992) best recommended Big Five adjectival markers. The instrument is often referred to as the TDA or “Trait Descriptive Adjectives”. A cursory glance at the TDA extraverted adjectives shows they are more socially desirable and positive than the TDA’s introverted adjectives. The extraverted adjectives used are Extraverted, Unrestrained, Energetic, Active, Daring, Vigorous, Bold, Verbal, Assertive and Talkative. The introverted adjectives used are Introverted, Unexcitable, Inhibited, Untalkative, Timid, Withdrawn, Reserved, Bashful, Shy and Quiet (Goldberg, 1992).

As suggested by Pettersson et al. (2014), evaluative bias is likely present in the TDA. The risk is that individuals with a more negative self-construct are more likely to agree with negatively evaluated items, and individuals with a more positive self-construct are more likely to agree with positively evaluated items. Ideally an instrument would ensure that irrespective of an individual's positive or negative self-construct, items are endorsed based on the “substantive” nature of their Big Five traits. In the above adjective based instrument, an individual may score more highly on the introverted adjectives than the extraverted ones, not because they are more introverted, but because of their negative valence as the “perceivers’ evaluative attitudes influence person judgments at least partly independent of the targets’ actual characteristics” (Leising et al., 2015, p.62).

The idea explored in this thesis, is that items at both ends of the polarities can be created and applied in a balanced way. This may mitigate the effect of valence biasing the measures. In so doing, this thesis also aims to explore how any valence effect may impact the measurement of the Big Five. The impact of valence and bias on our understanding of Big Five workplace validities is also considered.

1.6 Valuing Different Ways of Being

Psychometric tests provide an insight for test users to consider and evaluate. The meaning of the term “test user” in this thesis is as defined by Hopton, Kurz, MacIver, Saville and Chester (2016) and refers to an individual who interprets and makes use of the output from a test or assessment. This contrasts with the term “test taker”, which refers to an individual who completes a questionnaire, test or assessment (Hopton et al., 2016). A test taker may or may not also be a test user. It is not uncommon for a test taker with fewer traits at the socially desirable end of a scale, who then reads an interpretive report as a test user, possibly through self-critical responding, to feel less valued.

This poses a number of questions – does endorsing socially desirable content always imply adaptive behaviour, or is there the possibility that “too much of a good thing” could result in maladaptive behaviour? Could there be a tipping point? What is the role of context in determining to what extent traits manifest in adaptive or maladaptive ways? For example, Grant (2013) found more Extraverted individuals performed better in sales roles up to a certain point, but that too much Extraversion negatively impacted performance.

Jungian psychometrics are typically less subject to evaluative bias through using bipolar items that are evaluatively balanced at both ends, and through creating Jungian type reports based on the premise that there are “no good or bad, or sick or well types. All types are valuable” (Myers, McCaulley & Most, 1985, p. 53).

Building on this approach, this thesis seeks to value different ways of being by measuring both ends. This can help test takers feel more valued when they perceive the results of their assessment to be more balanced and their unique personality has been validated. This validation is likely to result in higher “user validity” (MacIver et al., 2014). This is particularly true for participants who would normally score low on one or more socially desirable ends of Big Five polarities, such as Introverted individuals or individuals low in Conscientiousness.

1.7 Research on Maladaptive Personality Traits at Work

De Fruyt and Salgado (2003) highlighted that occupational psychologists often evolve their theories independently of clinical psychologists' theories and vice versa. Guenole (2014) goes on to suggest that occupational psychologists have been slow to pick up on the latest clinical research on mental disorders and suggests that clinical concepts such as abnormal, deviant, pathological and aberrant behaviours can also be useful when applied in occupational settings.

One option would be to use the clinical Personality Inventory for DSM-5 (PID) which measures pathological personality traits. However, the PID's purpose is to screen for and assess personality disorders and "given the low base-rates in normal samples, assumed to be less than 3% (APA, 1994)" (De Fruyt & Salgado, 2003, p. 129) it is therefore inappropriate to use it in organisational settings with wider working populations. Research in Sweden estimated the base-rate to be 11.1% based on DSM-IV criteria (Ekselius, Tillfors, Furmark & Fredrikson, 2001, p. 311). Other research covering thirteen countries estimated the base-rate at 6% (Huang, Kotov, De Girolamo, Preti, Angermeyer, Benjet & Lee, 2009, p. 46). Even these higher percentages are still too low to consider using clinical tools organisationally. Furthermore, in a number of countries, completing a questionnaire based on mental disorders can be considered a medical examination which raises ethical and regulatory concerns.

Hogan and Hogan (1997) created the Hogan Development Survey (sometimes abbreviated to "HDS") which although based on the DSM IV Axis II mental disorder categories, is not designed as a clinical measure. For example, the category of "Obsessive-Compulsive" from the DSM is reframed as a continuous "Diligent" scale in the HDS. Leaders who score high on this scale may historically have excelled at diligently executing assigned tasks, but may in higher positions of responsibility "micromanage their staff, find it hard to delegate and have difficulty setting meaningful priorities for themselves and their subordinates" (Hogan & Hogan, 2009, p. 7). In essence, extreme measures of Conscientiousness may become a hindrance in certain roles and different contexts. It goes without saying that a lack of Conscientiousness may also negatively impact performance at work, although this does not feature in typical interpretations of the HDS. By way of contrast, in the

TalentQ Dimensions derailment report (Li, Stirling & Bourne, 2014) eight scales are measured whose extremes at either end could cause performance problems.

The HDS technical manual describes its scales as “dark side” traits and Li et al. (2014) refer to “derailment” traits. Critics have highlighted that some of these traits actually correlate positively with performance. For example, Kurz, Saville and MacIver (2010) found that the HDS “Diligent” and the TalentQ “Micromanagement” scales correlated positively with performance, as did the HDS “Colourful” and TalentQ “Exhibitionism” scales, yet they potentially label test takers as “risks” to an organisation. Kurz et al. (2010) suggests it is possible these scales are primarily measuring Conscientiousness and Extraversion respectively.

Guenole (2014) prefers to measure “maladaptive” traits and calls for more occupational psychologists to research the impact of such behaviours on performance at work stating, “we are interested in studying traits that predispose individuals to personality disorder among normal working populations” (Guenole, 2014, p. 86). Guenole (2015) has now developed marker items to measure six “maladaptive” traits based on the DSM-5 model.

In this thesis, a step is taken away from the clinical framework and the term “maladaptive” is simply used to refer to potentially overplayed manifestations (behaviours, thoughts and feelings) of Big Five traits that may, in a certain context, be unhelpful to performance at work, but are not designed to be indicators of mental disorders. The term “adaptive” is used in this thesis to refer to manifestations of Big Five traits that generally have a neutral or positive impact on performance at work.

1.8 Research on the Benefits of Introverted Leaders

Although feedback data provided by staff, peers and superiors on a leader’s performance at work typically finds that performance is positively correlated with Extraversion rather than Introversion (Barrick & Mount, 1991; Hough, 1992), there is nevertheless some evidence that Introversion can benefit a leader’s performance when the followers need to be proactive. Grant, Gino and Hofmann (2011) suggest “although extraverted leadership enhances group performance when employees are passive, this effect reverses when employees are proactive, because extraverted leaders are less receptive to proactivity.” (p. 528).

Other authors who have highlighted the leadership benefits of Introversion include Laney (2002) who coined the term the “introvert advantage” and Helgoe (2008) who makes the case for harnessing “introvert power” in the workplace and advocates the use of breaks and building in more time to think to improve performance. Jim Collins (2001) book entitled ‘*Good to Great*’ suggests organisations can achieve greater financial success by developing leaders who are quiet and reserved yet still independent and strong minded. Cain (2013) highlights the many benefits of Introversion in the workplace and discusses the unhelpful cultural bias in favour of Extraversion in the USA.

This thesis creates a measure of Introversion and explores the idea that Introversion can benefit a leader’s performance at work and seeks to quantify it. It does this through:

i. Measuring personality traits such as Introversion adaptively
ii. Measuring Introversion independently of, and not relative to, Extraversion.
iii. Measuring the impact on performance at work of both Introversion and Extraversion being overplayed i.e. maladaptive measures at both ends are quantified.

1.9 The Need for this Research

There is little or no research so far that has assessed the impact of measuring both ends of the Big Five in both an adaptive and maladaptive form on test users’ personal insights and on criterion validity, measured by 360 degree feedback in the workplace.

This thesis explores the psychometric merits of taking the Big Five factors and sub dividing each of them into separate measures at both ends of each factor. It then explores how Openness, Conscientiousness, Extraversion and Agreeableness can also be measured at each end in both an adaptive and maladaptive form, so creating four facets underneath these dimensions.

This approach involves separating out the descriptive and evaluative contents of items and was first advocated by Peabody (1967). Borkenau and Ostendorf (1989) built on this method which Bäckström et al. (2014) described as taking a trait and

presenting it as an item in four different ways, “One describes a high level of the trait with a negative valence, one a high level of the trait with a positive valence, one a low level of the trait with a negative valence and one a low level of the trait with a positive valence.” (p. 620).

By way of contrast, a typical Big Five model such as the NEO-PI-R (Costa & McCrea, 1992a) measures Extraversion through some items measuring Extraversion directly and some Extraverted reversed items, arguably measuring Introversion. It was not part of the psychometric design for the NEO-PI-R items to measure the Big Five dimensions in four different evaluatively balanced ways as advocated by Peabody (1967).

In this research, instead of creating one score for a Big Five dimension, four separate scales are created. An example using Extraversion illustrates this approach:

i. Extraversion in adaptive form
ii. Introversion in adaptive form
iii. Extraversion in maladaptive form
iv. Introversion in maladaptive form

There are three benefits to the approach in this research. Firstly, when reported back at the level of the Big Five, the measures are more evaluatively balanced. Secondly, reporting on the four scales within a factor provides greater fidelity and enables an exploration of the Big Five in a new level of detail. Thirdly, this greater level of fidelity can be used to explore the criterion validity and better help understand the relationship between personality and performance at work.

1.10 Research Aims and Research Questions

The first aim of this research is to measure both polarities of the Big Five dimensions as scalar opposites and independent constructs, in order to explore the known issue of differing degrees of social desirability present in Big Five models causing an evaluative bias (Bäckström et al., 2014) and impacting user validity.

The second aim is to measure the polarities of the Openness, Conscientiousness, Extraversion and Agreeableness dimensions in both adaptive and maladaptive forms and then to explore their relationship with highly dysfunctional constructs (Judge, Piccolo & Kosalka, 2009) such as the "dark side" traits measured in the HDS (Hogan & Hogan 1997, Hogan, Hogan & Kaiser, 2010).

The third aim is to establish if the new model (later in this thesis termed the BF57) could be useful to researchers through understanding the convergent and divergent validity of the scales, including locating them in the periodic table of personality traits (Woods & Anderson, 2016).

The fourth aim is to explore the positive and negative correlations between workplace performance and adaptive/maladaptive traits at both poles of each Big Five construct and in so doing, establish the criterion validity of the model.

Finally, the fifth aim is to shed light on the bandwidth / fidelity debate through empirically testing higher and lower level models on the data gathered.

The above aims are addressed through a novel application of Peabody's (1967) method for reducing evaluative bias. For each of the Openness, Conscientiousness, Extraversion and Agreeableness dimensions, the approach involves taking what would normally be one evaluatively unbalanced dimension and dividing it into four collectively balanced scales. Items are created to measure the low end of each scale, both adaptively and maladaptively. Items are also created to measure the high end of each scale, again adaptively and maladaptively.

This technique is combined with Burisch's (1986) recommended inductive, deductive and criterion-centric approach in order to develop an integrated Big Five model of personality. In so doing, the BF57 personality predictor model created sets out to successfully integrate the Big Five with ideas from both Jungian psychology and knowledge from other researchers on personality correlations with the Great Eight (Bartram, 2005) competency model. This is done in part through the quantification of performance at work through utilising a series of Great Eight (Bartram, 2005) based behavioural competencies assessed using 360-degree feedback. The BF57 is used to explore key research questions and test a number

of hypotheses in this thesis. Nine key research questions, coded RQ1 to RQ9 are explored in this thesis and detailed in Table 1-1.

Table 1-1: Nine Key Research Questions

RQ1: Is the proposed BF57 model of personality compatible with the Big Five factor structure?

RQ2: Where do the BF57 scales sit in the personality periodic table (Woods & Anderson, 2016) of blended Big Five factors?

RQ3: Do the BF57 adaptive scales correlate more highly than the BF57 maladaptive scales, with other “bright side” Big Five traits?

RQ4: Do the BF57’s maladaptive scales correlate more highly than the BF57 adaptive scales, with the HDS “dark side” traits?

RQ5: What evidence is there to support the conceptualisation of BF57 maladaptive scales as overplayed / overextended / extreme ends of the "bright side" Big Five traits?

RQ6: How well does the BF57 comply with *a priori* hypothesized criterion validity relationships with the Great Eight competency model?

RQ7: Is there a differential pattern of criterion validities between the BF57 adaptive and maladaptive scales and if so, what can be learnt from this?

RQ8: Compared to the BF57 five-dimensional bandwidth approach, can the higher fidelity BF57 eighteen scales explain more of the variance in the personality criterion relationship?

RQ9: Can the BF57 reduce the impact of evaluative bias in the Big Five?

1.11 Thesis Structure

Section 2 of this thesis is a literature review and starts by providing an overview of the history, development, alternatives to and criticisms of the Big Five. The Bandwidth-Fidelity argument is also reviewed. The issues of social desirability and evaluative bias are considered. The literature on dark side/maladaptive traits is

reviewed and the case for measuring maladaptive traits without referring to mental health models in an organisational context is made. This section then critically reviews the literature on competency models and makes the case for using the Great Eight model for criterion validity purposes in this thesis.

Section 3 details the methodology used in this thesis and outlines the validation strategies used: construct validity; convergent and divergent validity; criterion validity and test re-test reliability. The application of Burisch's (1986) deductive, inductive and criterion-centric approach to questionnaire development adopted for this thesis is described.

Section 4 details the creation of an item pool to measure the eighteen Big Five-based personality variables. The procedure for scale and item-development is described along with the approach to mitigating the risk of any scale becoming a bloated specific. A confirmatory factor analysis is used to further understand the structure of the model created and test for the presence of the Big Five.

Section 5 explores the concurrent validity of the new BF57 questionnaire through identifying and testing hypothesised relationships with other instruments, including the IPIP-NEO (Johnson, 2014), the HPI "Bright Side" (Hogan & Hogan, 1995), the HDS "Dark Side" (Hogan & Hogan, 2001) and Goldberg's (1992) one hundred "Trait Descriptive Adjectives" (TDA). This section also places the new BF57 scales within the periodic table developed by Woods and Anderson (2016).

Section 6 tests hypotheses relating to criterion validity based on 360-degree feedback data on performance at work. The 360-degree instruments include a measure of the Great Eight competency model, a 360-degree leadership model and a 360-degree professional competencies model for individual performers. The criterion-related validity of the BF57 is tested using *a priori* derived hypotheses on the relationship between the proposed personality dimensions/scales and with the Great Eight Competencies (Kurz & Bartram, 2002; Kurz, 2003; Bartram, 2005).

Section 7 details how a second sample was used to re-validate the five dimensions and the eighteen scales. It further explores the factor structure based on the new data set. A test-retest analysis is detailed.

Section 8 describes how observer feedback was gathered using the BF57 questionnaire and a consensual validity study undertaken. The self-perception of the eighteen scales are correlated with that of the feedback group.

Section 9 seeks to measure the evaluative bias in the TDA, IPIP-NEO and BF57 and compare the instruments.

Section 10 is a final discussion and concludes the thesis by integrating the findings across the studies in the light of the latest literature. The theoretical and practical implications of the research are considered, as are a number of limitations of the research.

2 LITERATURE REVIEW

This review considers how the measurements of personality, and the theories they are based on, have evolved since its early inception 130 years ago. The researcher's need for a comprehensive taxonomy is discussed and the evidence supporting the Big Five as the answer to these needs considered. More contemporary theories that acknowledge both the biological basis of personality and the impact of the environment are explored and the case for a more holistic approach being adopted in this research is made. In so doing, a number of variations and alternatives to the Big Five are considered, including the merits and downsides to a number of Jungian approaches. The predictive power of personality models in the workplace is then reviewed in the light of the bandwidth fidelity debate (are higher level or lower level models more predictive?). The literature on what may limit performance is also considered and the so called 'dark side' of personality explored. The application of models based on mental disorders versus approaches that assume performance can also more commonly be impacted by extreme use of 'bright side' traits is considered. Finally, a comprehensive review of the literature on competencies at work is undertaken and the case for the criterion models adopted in this research made.

2.1 Perspectives on Personality

2.1.1 Early Developments and Some Controversies

The birth of the psychometric profession can be traced back to the University of Cambridge in the UK in 1887 when American psychologist James McKeen Cattell established the first British laboratory of psychology within Cambridge's Cavendish Physics laboratory, having to overcome the objections of the senate of the day who thought the "laboratory would insult religion by putting the human soul in a pair of scales" (Sokal, 1972). The laboratory has evolved over 130 years to take the form today of the Cambridge Psychometrics Centre, with recent research by Lambiotte and Kosinski (2014) finding evidence "that a wide range of pervasive and often publicly available digital footprints such as Facebook profiles or data from mobile devices can be used to infer personality" (p. 1,938).

Just as psychometrics were seen by some as a threat to religion in 1887, they are also seen by some as a threat to democracy in 2017. Both the 2016 Trump and Brexit campaigns used Big Five social media profiling to target their political messages (Grassegger & Krogerus, 2017) causing Kosinski to warn against such usage and state “This is not my fault. I did not build the bomb. I only showed that it exists.” (Kosinski, 2017, p. 1).

John Rust from the Cambridge Psychometrics Centre commented on such political usage of our digital footprints saying “a computer can actually do psychology, it can predict and potentially control human behaviour. It’s what the scientologists try to do but much more powerful. It’s how you brainwash someone. It’s incredibly dangerous.” (Rust, 2017, p. 1).

This thesis explores another objection some have to psychometrics, that of bias. Whilst many countries now have laws to protect the population against discriminatory use of psychometrics on the basis of religion, gender or ethnicity, there is little or no legal protection against bias within the psychometric itself for favouring certain ways of being over others. This thesis aims to explore potential bias in each polarity of the Big Five measures.

2.1.2 What is Personality?

Howarth and Cattell (1973) asserted that personality is “that which enables us to predict what a person will do in a given, defined situation” (p. 799). Their work prompted many trait theorists to use factor analysis and encouraged them to attempt to define personality as a set of measurable traits that are stable across time (Eysenck, 1967; McCrae & Costa, 1985).

Allport (1961) defined personality as “the dynamic organization within the individual of those psychological systems that determine his characteristic behaviour and thought” (p. 28). McCrae and Costa (2003) asserted that “traits are endogenous basic tendencies that give rise to consistent patterns of thoughts, feelings and actions” (p. 204). After reviewing over three decades of personality research, a richer definition was provided by Pervin (2003) who suggested personality was “the complex organization of cognitions, affects, and behaviors that gives direction and pattern (coherence) to the person’s life. Like the body, personality consists of both

structures and processes and reflects both nature (genes) and nurture (experience). In addition, personality includes the effects of the past, including memories of the past, as well as constructions of present and future" (p. 414).

All the above definitions imply knowledge of an individual's personality can be used to predict behaviour across situations with a degree of confidence.

2.2 Personality and the Origins of the Big Five

2.2.1 Researchers' Need for a Personality Taxonomy

In order to make progress on a scientific understanding of how personality predictors correlate with job performance, researchers need models. Just like the "g" factor as a construct model of ability (Jensen, 1998; Kurz, 2000) has allowed research to progress by empirical accumulation and confirmation of the role that ability plays in predicting job performance, Barrick and Mount (1991) proposed the use of the Five-Factor Model of personality as a taxonomy under which to investigate the relationship between personality and job performance.

2.2.2 The OCEAN Acronym for the Big Five

Proponents of the "Big Five" typically measure the model with the following dimensions and factors using the acronym OCEAN (Barrick, Mount & Judge 2001):

1. **O**penness to experience which typically comprises 'intellectance', creativity, unconventionality, and being broad-minded.
2. **C**onscientiousness, which is associated with dependability, achievement, striving, and 'planfulness'.
3. **E**xtraversion, typically consisting of sociability, dominance, ambition**,** positive emotionality, and excitement-seeking.
4. **A**greeableness, typically defined by co-operation, trustfulness, compliance and affability.
5. **N**euroticism, often characterised by anxiety, hostility, depression, and personal insecurity.

The OCEAN acronym is used by many Big Five models such as the NEO-PI instrument (McCrae & Costa, 1989) which is one of the most popular approaches to measuring the Big Five in academia.

2.2.3 Big Five Roots

It was Sir Francis Galton in 1884 who first hypothesised that language could be the basis of a taxonomy of personality traits and was arguing for the lexical hypothesis when he stated, “I tried to gain an idea of the number of the more conspicuous aspects of the character by counting in an appropriate dictionary the words used to express them. Roget’s Thesaurus was selected for that purpose and I examined many pages of its index here and there as samples of the whole, and estimated that it contained fully one thousand words expressive of character, each of which has a separate shade of meaning, while each shares a large part of its meaning with some of the rest” (Galton, 1884, p. 181). The assumption is that important personality traits will over time become summarised by single words and that the words most used will represent the most important traits within a culture.

Jung adopted a different approach and based his personality model on observations of patients and a study of his own personality stating “… my typology is the result of many years of practical experience – experience that remains completely closed to the academic psychologist” (Jung, 1921, p. xiii). This perspective has arguably done little to encourage academic psychologists to build on Jung’s theory empirically. Jung went on to say, “I am first and foremost a doctor and practicing psychotherapist, and all my psychological formulations are based on my experience gained in the hard course of my daily professional work”. (Jung, 1921, p. xiii). That said, although Jung’s work is rarely cited when academic psychologists describe the genesis and development of the Big Five, it is worth noting that it was Jung himself who popularised the terms Extraversion and Introversion that have been adopted by the Big Five. It was 1917 when Jung first documented his use of the term “der extravertiert Typus” (Jung, 1917, p. 74).

Although Jung himself never created a psychometric to operationalise his model, others have attempted to do so. The “Grey-Wheelwright” Jungian psychometric was developed in the 1940s (Wheelwright, Wheelwright & Buehler, 1964). They

measured the Jungian “attitude” of Extraversion / Introversion, as well as the two Jungian “preferences” of Thinking / Feeling and Sensing / Intuition.

The “Singer Loomis” model (Singer, 1984; Arnau, Rosen & Thompson, 2000) adopted a different approach and attempted to directly measure Jung’s eight types (Jung, 1921) consisting of extraverted thinking, introverted thinking, extraverted feeling, introverted feeling, extraverted sensing, introverted sensing, extraverted intuition and introverted intuition. However, research using the “Singer Loomis” model has been unable to produce a factor analysis that would justify the proposed structure.

The “Type Dynamics Indicator” (Childs & Myers, 2015) measures the same dimensions as the Myers-Briggs Type Indicator, commonly known by the trademarked term MBTI, (described below) but does so with items that measure how an individual currently is, as well as how they would like to be. The “Jung Type Indicator” (Budd, 1993) also measures the same dimensions as the MBTI which it correlates highly with.

As measured by the MBTI (Myers & Myers, 1995) instrument, Extraversion / Introversion, as well as Thinking / Feeling and Sensing / Intuition seem to describe similar traits to those of three of the Big Five’s dimensions. For example, McCrae and Costa (1989, p. 30) found the Big Five NEO-PI Openness correlated 0.72 with the MBTI instrument’s Sensing to Intuition, Extraversion correlated 0.74 with the MBTI’s Introversion to Extraversion and Agreeableness correlated 0.44 with the MBTI’s Thinking to Feeling. The MBTI authors added a fourth measure to Jung’s model and termed it Perceiving versus Judging. The NEO-PI Conscientiousness scale correlated with the MBTI’s Perceiving to Judging at 0.49 (McCrae & Costa, 1989).

Even without correcting these correlations for measurement reliability, and assuming the MBTI is a reasonable measure of Jung’s personality theory, the correlations are sufficiently high to suggest that as early as the 1920s, Jung (1921) may have suggested the existence of three personality dimensions, that some fifty years later have been confirmed through the quantitative approach of Big Five researchers.

With seemingly little reference to Jung's model, the lineage of research that started with Galton's lexical work, was built on by Allport and Odbert's (1936) in their psycholexical study, that comprehensively documented over 4,500 adjectives that described different traits.

In the late 1940s, Cattell pioneered the then ground-breaking factor analytic approach and used it to reduce the 4,500 adjectives to 35 variables (Cattell, 1948). Further analysis eventually produced the 16PF model with 16 factors (Cattell, Eber & Delhees, 1968).

Further factor analytic research was undertaken by Fiske (1949) and then in April 1961 Tupes and Christal (1992) published further factor analyses using Cattell's 1940's data sets and the first form of the five-factor model was born. In 1961, they termed what was later to become Openness as "Culture", Conscientiousness as "Dependability", Extraversion as "Surgency", Agreeableness was coined by Tupes and Christal and Neuroticism was described in the reversed form of "Emotional Stability". The use of the acronym OCEAN was later popularised by McCrae and Costa's (1989) Big Five model.

2.2.4 The Theories Behind the Big Five

Miner (2007, p. 8) has asserted that the Big Five is little more than "dust bowl empiricism" (Nugent, 2013) suggesting "that no theory is involved at all. However, the result may look very much like a theory". Revelle (1987) also criticized the Big Five approach and suggested it was atheoretical. Gomà-i-Freixanet, Wismeijer and Valero (2005, p. 279), commenting on the work of Costa and McCrea (1995) suggested the NEO PI-R model was "essentially atheoretical in its origin and descriptive of traits that are uniquely human and do not translate easily into comparative descriptions of animal behavior traits".

By way of contrast, although the model of Jungian typology was not developed through empirical psychometric methods, it was nevertheless derived directly from Jung's theory (Jung, 1921). Critiques of the Big Five have suggested that unlike Jung's elegant theory, the Big Five lacks a comprehensive theory.

Wiggins and Trapnell (1996) responded to such accusations by advocating the dyadic-interactional perspective as a plausible theory underpinning the Big Five approach. This suggests that “personality trait expression is a fundamental part of human nature and failure to express one’s traits leads to anxiety” (Tett & Burnett, 2003, p. 504). This theory describes how individuals will look for the opportunity to express their preferred personality traits by engaging with other people and work activities that enable this expression.

An analysis of the Big Five roots and the above historic timeline suggests that the approach emerged from the factor analytic approach as advocated by Cattell (1948). “In a narrow sense, the five-factor model (FFM) of personality is an empirical generalization about the covariance of personality traits” (McCrae and Costa, 1999, p. 159) which is tantamount to confessing to dust bowl empiricism. However, although Costa and McCrae (1992a) did develop their FFM using factor analytic approaches, they also went on to develop the “five-factor theory”. Their approach is typically referred to as the “Five Factor Model”, often shortened in literature to the acronym “FFM”.

The five-factor theory views personality as a dynamic system (McCrae & Costa, 1999) in which traits influence multiple psychological processes including:

i. Interpersonal processes, such as striving to influence others
ii. The formation of identity
iii. Emotional expression and/or suppression
iv. Applying self-discipline and a goal focus
v. Defence mechanisms, such as being optimistic or repressing thoughts
vi. How we perceive and process information

The theory also considers there to be six elements at work within the dynamic system. Firstly, the theory assumes there is in part a biological basis for traits and that these traits are partly inheritable (McCrae, Costa, Ostendorf, Angleitner, Hřebíčková, Avia, Sanz, Sanchez-Bernardos, Kusdil, Woodfield, Saunders and Smith, 2000).

Secondly, it assumes traits are in part dispositional and as such may not be visible to observers or even comprehensible to the individual through reflection. They termed these dispositional traits “basic tendencies”.

Thirdly, the theory assumes that these dispositional traits influence the characteristic adaptations that lead to behaviour (McCrae & Costa, 1996). However, five-factor theory assumes the reverse is not possible. That is, expression of behaviour and characteristic adaptations can have no impact or influence back on dispositional traits.

Taken together, these first three assumptions support McCrae and Costa’s (1996) perspective that Big Five traits are a combination of thoughts, feelings and behaviours and that they possess a biological origin.

Fourthly, the theory assumes our personality includes our self-concept (how we implicitly and explicitly perceive ourselves, as well as our self-esteem). McCrae and Costa (1996) view personality as a dynamic system in which our self-concept is impacted by our basic tendencies as well as our characteristic adaptions.

The fifth assumption in the theory is that we possess an ‘objective biography’ based on historical accidents, how our careers unfold and specific emotional reactions we have experienced.

The sixth assumption is that we are subject to “external influences” through our childhood, educational experience, the culture we are brought up in, key events in our life and more. Both the objective biography and the external influences influence our self-concept.

These six elements are in turn underpinned by a further set of four assumptions key to the five-factor theory (McCrae & Costa, 1996):

i. Variability - simply put, this is the assumption that individual differences in personality do exist
ii. Proactivity - behaviour stems from traits within an individual
iii. Knowability - studying personality is scientifically possible and creates insights into human nature

iv. Rationality - individuals use language to make sense of personality and they use language to rationally understand their own personality and others'

A slightly different approach was adopted by Goldberg (1992, 1993) who returned to working with adjective check lists and created models based on "lexical theory". Goldberg's work is largely based on this psycholexical approach and is typically referred to as a "Big Five" model, whereas Costa and McCrea's model is referred to as a "Five Factor Model" or "FFM". For simplicity, in this thesis the term Big Five has been used as the preferred high-level descriptor of both approaches.

Hogan (1996) advocated "socioanalytic theory" and used this theory to develop his Big Five model. Socioanalytic theory suggests "The FFM contains the categories that people use to evaluate one another, through the vehicle of reputation, these categories reveal the amount of status and acceptance that a person has been granted, and that he or she can normally expect to receive" (Hogan, 1996, p.173). Hogan's models are therefore typically built using observer data, rather that the self-report data favoured by Costa and McCrea's FFM approach. Hogan views traits as socially constructed, rather than biologically based. Socially constructed reputations are nevertheless encoded in traits that are stable over time and can therefore be used to predict performance at work (Hogan, 1996). Hogan's approach suggests that due to an individual's lack of self-awareness or their self-deception biases, self-report questionnaires may not accurately measure a person's reputation or their behaviour. Hogan advocates instrument design being based on 360-degree observer data.

Hogan suggests that an individual's reputation will determine whether they are successful at work or not. He refers to this as "the game of life", going on to say, "Because the game, at a deep level, concerns reproductive success, it is ultimately quite serious" (Hogan, 1996, p. 173).

Buss (1996) advocated "evolutionary theory" to explain the Big Five and suggests that the ability to perceive personality differences in others is critical both for survival and for reproduction (Buss, 1996). Buss identifies three types of relationship to which perceiving the Big Five in others may be helpful. These are; heterosexual mating relationships, coalitions formed to achieve shared goals, and dyadic reciprocal friendship (Buss, 1996). From an evolutionary perspective, for all three of

these relationships, an individual will exaggerate their adaptive traits to impress others and simultaneously exaggerate the maladaptive traits of others they see as competitors (MacDonald, 1998).

Nettle (2009) explains how evolution not only accounts for the existence of the Big Five, but also elegantly explains why individual differences in Big Five traits persist over time. This is important as Fisher's (1937) fundamental theorem argues that after genetic mutations occur, the winnowing effect will ensure the optimal level of a characteristic in a given environment will become more common over time. So why would individual differences in the Big Five appear to persist over generations?

Nettle (2009) explored this question and identified the evolutionary costs and benefits that increasingly high scores in all five of the big five dimensions bring. He found that as there is no one optimal level of the big five dimensions for all contexts at all times, that rather than winnowing a population's Big Five dimensions over time to the one best suited to survival, it is natural selection itself that actually ensures a range of genetic variants in personality traits persist in the population over time.

Nettle (2009) also summarises the work of behavioural geneticists that concludes the heritable proportion of personality is approximately fifty percent (p. 210). One source of the fifty percent estimate is numerous studies on identical twins (who are genetically identical) and non-identical twins (who share fifty percent of their genetics). Results show that identical twins are more likely to have similar Big Five dimensions than non-identical twins, and this supports a calculation that concludes approximately fifty percent of personality is genetic (Nettle, 2009).

2.2.5 Towards More Holistic Theories of Personality

Moving away from more reductionist psychometric theories, some authors have advocated the need to integrate a more holistic approach that emphasises the adaptability of personality. This may be considered a more humanistic approach.

For example, "Trait Activation Theory" is advocated by Tett and Burnett (2003). This theory suggests that the situation has a strong influence on if and how different personality traits are expressed (Tett & Burnett, 2003) and is one plausible explanation for Barrick and Mount's (1991) finding that a trait may be predictive in

some situations, but not in others. This suggests the social context may impact our personality and how we express it. McKenna and Bargh (1998) developed a questionnaire for assessing how much of a person's "real me" could be expressed in a given social context. They found that people with low Extraversion and high Neuroticism were able to express their real me online more easily than in traditional face-to-face social interaction. This suggests that the expression of our personality may differ according to the social setting.

Most recently Cook (2016) set out to establish if adaptability of personality exists as a trait and found evidence that some people are more adept than others at tuning up or tuning down different personality traits, dependant on the context. Cook (2016) defined personality adaptability as "The accurate and goal directed selection of personality states across situations which is designed to gain desired outcomes and which may result in behaviour which is in accordance or discordance with the individual's personal preferences in any given situation." Cook (2016, p 13).

Interestingly, Cook (2016) hypothesises that in order to adapt one's personality in this way requires a threshold of intellectual functioning in order to read the situation, recall previous similar and different situations, and to apply thinking processes that will help determine the most effective adaption.

Rogers (1951) advocated humanistic psychology and suggested personal development included discovering one's true self, and that individuals have a need to express their true self and be recognised for it socially.

In this context, a self-report personality measurement may be a useful starting point for exploration of one's true self, and the exploration could be a catalyst for expressing one's true self in dialogue with others.

Other approaches to humanistic psychology may not see use for self-report personality measures in discovering one's true self. For example, Rowan (2010) suggests we do not have just one personality, but several sub-personalities that manifest in different contexts. Consequently, from this perspective, any personality test that measures just one personality must be misleading and to measure an individual's Big Five without measuring their sub-personalities would be an over-simplification which may lead to reification of the Big Five. Reification was described

by Whitehead as “misplaced concreteness” (Kelly, 1998, p. 125) and in the context of personality involves treating the Big Five as if it were a real thing. On this basis, some humanistic approaches would reject the use of psychometrics to measure personality.

Some psychologists have created theories that bridge the reductionist versus humanistic perspectives. For example, McAdams (2001) has defined a three-level model of personality that assumes the highest level is based on five general personality dimensions and assumes that everybody possesses all five of them in varying degrees. McAdams’ second level assumes that two individuals with identical levels of the five dimensions will typically have very different ways of expressing these dimensions in their behaviour. This will in part be guided by the experiences and opportunities that present themselves in an individual’s environment as they grow up. The third level is based on McAdams’ (2001, p. 100) life story model of identity, which emphasises the subjective narrative an individual tells themselves in order to explain who they are and why they do the things they do. McAdams’ model is appealing in that in draws on the quantifying and predicting approach of Howarth and Cattell (1973) as well as the humanistic approach of Rogers (1951).

2.2.6 The Biological Roots of the Big Five

The idea that personality has its basis in biology can be traced back to the original work by Eysenck (1967). This view is supported by Roberts and Jackson (2008) and Funder (2015) also suggests that personality traits are fairly stable over time, biological in origin and have been subject to the process of evolution. This definition also suggests that traits can be observed as they manifest through behaviour.

In their ground-breaking study using MRI (Magnetic Resonance Imagery), DeYoung, Hirsch, Shane, Papademetris, Rajeevan and Gray (2010) found support for this biological basis of the Big Five by identifying the co-variance of brain structure with four out of the big five factors. For example, Neuroticism covaried with the volume of brain region associated with punishment, and negative affect. This study demonstrated the potential of personality neuroscience as a field.

Although DeYoung et al. (2010) did not find a correlation for Openness with brain structure, a more recent study by Beaty, Benedek, Silvia and Schacter (2016) used

fMRI (functional Magnetic Resonance Imaging) and found a link between an individual's score on Openness and the level of functioning of the brain's default network. Their results explained 18% of variance in the default network functioning by the individual's Openness score, which suggests a biological basis for Openness.

Recently a study by Nostro, Müller, Reid and Eickhoff (2016) found that grey matter volume (GMV) was associated with personality in the male sample, but not the female sample. This may indicate an important role of gender when it comes to studies associating GMV and personality.

Riccelli, Toschi, Nigro, Teraccino and Passamonti (2017) found that the cortical thickness and surface area/folding were related to Big Five traits. For example, having a thicker cortex and smaller area / folding in the prefrontal regions was correlated with Conscientiousness. "These findings demonstrate that anatomical variability in prefrontal cortices is linked to individual differences in the socio-cognitive dispositions described by the FFM" (Riccelli et al., 2017, p. 671). Finally, another study found a link between Extraversion, the dopaminergic neural reward system and genetics (Cohen, Young, Baek, Kessler & Ranganth, 2005).

Others have tested for the correlation between hormones and personality, finding correlations between an individual's levels of testosterone and their level of Extraversion (Sellers, Mehl & Josephs, 2007).

Some researchers are advocating further work on the link between neuroscience and personality and are suggesting that in the future it may be possible to measure personality directly from brain activity (DeYoung, 2015).

2.3 Variations of, and Alternatives to, the Big Five

Although there is a general consensus towards a five-factor model of personality, there are still many who advocate a different number of factors.

2.3.1 Eysenck's Three Factor Model

Eysenck (1991) originally advocated a two-factor solution based on Extraversion and Neuroticism. Eysenck mapped a two-dimensional version of the model onto the Greek physician Hippocrates "humours", namely:

i. High Neuroticism and high Extraversion made the Choleric type
ii. High Neuroticism and low Extraversion made the Melancholic type
iii. Low Neuroticism and high Extraversion made the Sanguine type
iv. Low Neuroticism and low Extraversion made the Phlegmatic type

The model was also displayed as a circumplex, with adjectives around the outside of the wheel describing combinations of the two factors.

After further research with his wife, a third factor named “Psychoticism” was added (Eysenck & Eysenck, 1975) and the expanded model named the P-E-N model. The Eysenck Personality Questionnaire was developed and is based on the Eysencks’ theory that physiology and genetics drive temperament which can effectively be measured through three factors described at both ends of the polarities as Introversion to Extraversion, Stability to Neuroticism and Socialisation to Psychoticism.

Zuckerman, Kuhlman, Joireman, Teta, and Kraft (1993) found Eysenck’s Extraversion and Neuroticism to be similar to the Big Five definitions of the same terms. In their research on the P-E-N model, Goldberg and Rosolack (1994) found the three factors Extraversion, Neuroticism and Psychoticism and concluded the model did have factorial clarity.

However, when the P-E-N data was analysed in combination with Goldberg’s one hundred adjective markers, Goldberg and Rosolack (1994, p. 16) found Psychoticism to be a combination of what the Big Five calls “low Conscientiousness” and “low Agreeableness” measured somewhat maladaptively. The P-E-N Psychoticism un-attenuated correlation with Agreeableness was -0.40 and with Conscientiousness was -0.45. They commented that “The root of the problem with Psychoticism is its low internal consistency” (p. 18) which was found to have a mean item inter-correlation of just 0.07, although Cronbach’s Alpha (Cronbach, 1951) for the Psychoticism scale is acceptable at 0.63.

One modern day challenge with the factor being named “psychoticism” is that this term is used in the DSM-5 to define a different construct. This is an example of the

"jingle" (Corsini, 1999, p. 514) aspect of the "jingle/jangle fallacy" at work, where identical scale names in different models actually measure quite different things.

2.3.2 Six, Seven, Eight, Nine and Sixteen Factor models

Ashton, Lee, Penugini, Szarota, De vries, Di Bias, Boates, and De Raad (2004) advocate the use of the HEXACO six-factor model. It is similar to the NEO-PI-R five factor model, with an additional factor identified termed "Humility". Simms (2007) created a seven-factor model, as did Tellegen and Waller (2008) and Hogan and Hogan (1995).

Saville, Maclver and Kurz (2009) built on the eight-factor model that sits at the interface between personality and competency at work to create "Wave Professional Styles" using a criterion-centric (Burisch, 1986) development approach where each Great Eight factor was covered by 5 or 6 criterion dimensions. The development of this model is further expanded upon later in this literature review in the section on the "Great Eight" model. The approach of Saville et al. (2009) builds on the work of Robertson and Kinder (1993) who were one of the early researchers who advocated organising personality models around performance criteria to enhance predictive validity, thus laying the ground work for the criterion-centric approach.

Hough (1992) advocates a nine-factor approach and Cattell, Eber and Delves (1968) are famous for the sixteen-factor 16PF instrument.

2.3.3 Two Higher-Order Factors

Digman (1997) analysed the Big Five and found two higher-order factors emerging across multiple studies. "One was principally related to the Big Five trait dimensions Agreeableness, Conscientiousness, and Emotional Stability; the other, the dimensions Extraversion and Intellect." (p. 1,246). He termed them Alpha and Beta factors. DeYoung (2010) found a similar structure and after exploring the possible neuropsychological basis named the Alpha factor "Stability", finding links to the Serotonergic system. He named the Beta factor "Plasticity" and found links to the Dopaminergic system. DeYoung's (2015) research supports the argument for a biological basis of personality that is moderated by the environment. DeYoung, Quilty and Peterson (2007) break down the two higher order Alpha and Beta factors into the Big Five, and then in turn break down the Big Five down into ten aspects,

with two aspects for each Big Five dimension. Openness breaks down into Intellect and Openness. Conscientiousness breaks into Industriousness and Orderliness. Extraversion breaks into Enthusiasm and Assertiveness. Agreeableness breaks into Compassion and Politeness. Finally, Neuroticism breaks down into Volatility and Withdrawal.

2.3.4 The Big One – a One Factor Model

In his 2007 study, Musek statistically identified in the Big Five Personality structure the General Factor of Personality, termed the "GFP" or "The Big One".

"The Big One was interpreted as a basic personality disposition that integrates the most general non-cognitive dimensions of personality. It is associated with social desirability, emotionality, motivation, well-being, satisfaction with life, and self-esteem." (Musek, 2007, p. 1,213).

A substantial body of research to date confirms the existence of the General Factor of Personality as the apex of the personality hierarchy (Hengartner, Linden, Bohleber & Wyl, 2016). Hengartner et al. (2016) have shown the General Factor of Personality and the Big Five moderate stress responses.

Goldberg (1993) had hypothesized that only evaluation would be found in searching for higher order factors above the Big Five. The work of Digman (1997), DeYoung et al. (2007) and Muesk (2007) has refuted this in an absolute sense, whilst still acknowledging that social desirability (Costa & Lord, 2004) is an important part of the Big One.

Critiques of the Big One report it is too high level to be of practical use in organisations and Bailey (2013, p. 63) compared the criterion validity of a Big One approach with a lower level facet based approach using the 16PF and concluded there was "increased predictive power when using more granular personality data".

A summary of the relationship between the General Factor of Personality, Digman and DeYoung's two higher order factors, the Big Five and Eysenck's P-E-N model is shown in Figure 2-1.

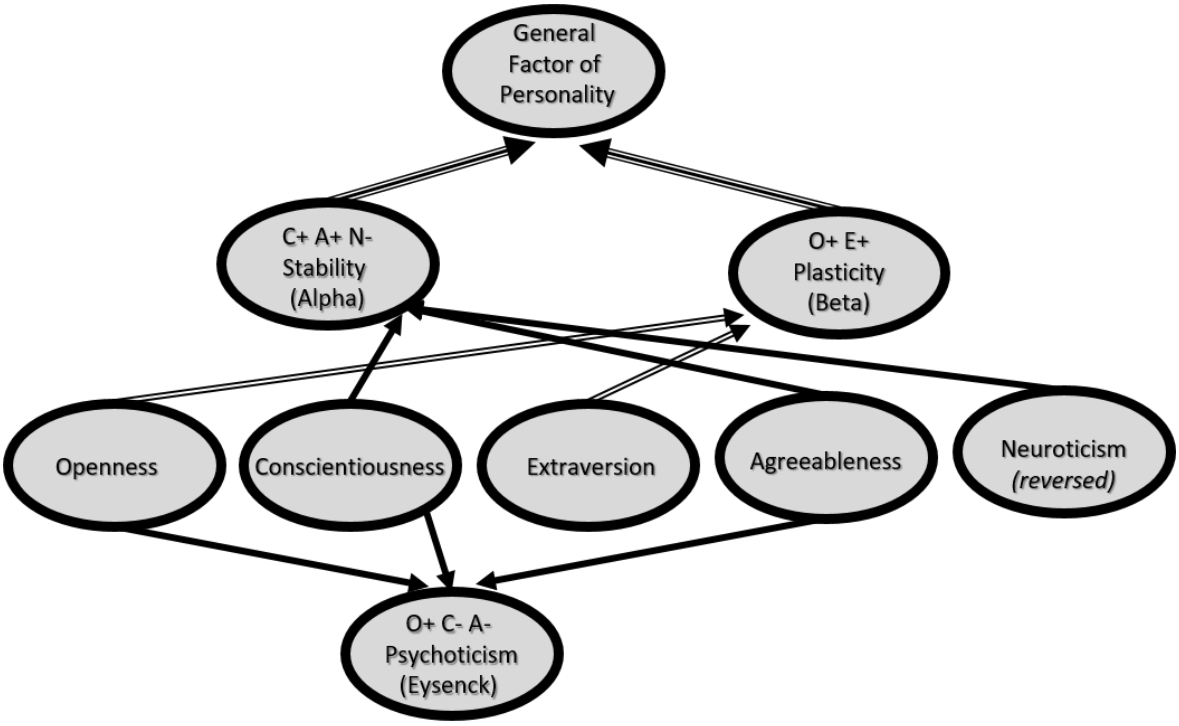

Figure 2-1: Diagram of GFP, two higher order factors, the Big Five and Eysenck's P-E-N model

2.3.5 Jung's Three Factor Model

Although Jung (1921) did not create his personality model based on inductive factor analytic methods, his model has nevertheless been validated by others as possessing three factors, as evidenced by the "Grey-Wheelwright" psychometric (Wheelwright et al., 1964) which was the first psychometric to be created based on Jung's theory of Psychological Type (Jung, 1921). It was developed in the 1940s (Wheelwright et al., 1964) and took the form of a three-factor model measuring the Jungian "attitude" of Extraversion / Introversion, as well as the two Jungian "preferences" of Thinking / Feeling and Sensing / Intuition.

2.3.6 Myers-Briggs Type Indicator (MBTI) Four Factor Model

The most popular psychometric application of Jung's theory is the MBTI (Myers & Myers, 1995). Research by Schaubhut, Herk and Thompson (2009, p. 16) presents evidence of strong construct validity through a factor analysis on the 93 items in the MBTI Form M. The results showed all items loaded most strongly on the intended factor and that the results had achieved simple structure. This was based on a principal components factor analysis with varimax rotation. The sample size was 10,000 with 5,000 men and 5,000 women in the study. Johnson and Saunders

(1990) also found a four-factor model was a good fit for the MBTI model and conducted a confirmatory factor analysis that successfully tested this hypothesis.

In the psychological community, the MBTI has many critics, such as Pittenger (1993) who reported that even with just a five-week test-retest interval, 50 percent of people may be recorded as shifting types. Whilst this is a valid criticism, the root cause of the weak evidence for test-retest is down to the model splitting each factor into two at the midpoint. Given the data is largely normally distributed, cutting it at the midpoint significantly increase the probability that a participant taking the instrument again, who scored near the midpoint the first time, may be classified as a different type the second time, even though they may have only answered one question differently. The MBTI does have good test-retest performance if instead of basing the measure on type allocation, the underlying continuous scores for the four factors are measured on two occasions and correlated. It can be argued the factor structure and test-retest statistics for the MBTI (Myers, McCaulley & Most, 1985) are comparable to those of other Big Five models. It is plausible that if the MBTI was to divide its dimensions into three, for example, classifying people not just as Introverts and Extraverts, but as Introverts, Ambiverts and Extraverts, then their test-retest statistics would improve accordingly.

Even despite the weak reliability of the test retest statistics at the type level, there is still strong evidence that the MBTI types are present in different occupations in statistically significant amounts (Myers et al., 1985).

Nevertheless, many such as Hunsley, Lee, and Wood (2003) have highlighted some of the MBTI's shortcomings in terms of its scientific validity. Rust (2016, p. 1) from the Cambridge Psychometrics Centre has gone as far as to say the MBTI "leads people to believe they have a type, which is more like astrology." Based on evolutionary psychology, Nettle (2009) makes a convincing case against typing and concludes that "personality schemes which divide people into discrete types are biologically implausible" (p. 60) as natural selection operates on gradations in phenotypic expression.

The MBTI uses a forced choice bipolar item structure which embeds the assumed dichotomy into the item. McCrae and Costa (1989, p. 17) have questioned this assumption and their research concluded "there was no support for the view that

the MBTI measures truly dichotomous preferences or qualitatively distinct types". Goldberg (1992, p. 32) found bipolar item structures can be problematic even when they load clearly on one factor. For example, "moody – steady" when assessed as a bipolar item loads onto Neuroticism / Emotional Stability. However, when assessed as two separate unipolar items, "moody" loads onto Neuroticism / Emotional Stability, but "steady" loads onto Conscientiousness.

McCrae and Costa (1989, p. 32) concluded that "the MBTI does not seem to be a promising instrument for measuring Jung's types, those who embrace Jung's theory should probably avoid the MBTI".

The MBTI asserts that there will be a dominant Jungian preference chosen from the four preferences of Thinking, Feeling, Sensing and Intuition. It also asserts that this choice will be based on the scores for the Introvert / Extravert and Perceiving / Judging scales, and not be related to the absolute score an individual has for Thinking / Feeling or Sensing / Intuition. McCrae and Costa (1989), referring to the Perceiving / Judging scale as JP, found no evidence to support these assertions and recommend "MBTI users might wish to reconceptualize the JP scale as an index of preference for structured versus spontaneous living" (p. 35) and they demonstrated how an analysis of the MBTI's items support their view, as well as other external validity correlations.

Nevertheless, some have defended the MBTI, such as Bess, Harvey and Swartz (2003) who found its factor structure to provide a "very firm empirical foundation that can be used to justify the use of the MBTI as a personality assessment device in applied organizational settings" (p. 4). Despite this, the same authors (Bess, Harvey & Swartz, 2002) also found its scores centre-weighted and could not find evidence of a bimodal distribution that would be consistent with some interpretations of Jung's type theory (Jung, 1921). McCrae and Costa (1989) also concluded most individuals are somewhere in the middle on a continuum and rejected the idea of Jung's types. Interestingly, they also showed that the MBTI's scales converged reasonably well with four of the Big Five's dimensions.

Although they did not find evidence of the MBTI sixteen types in a number of samples, Costa, Herbst, McCrae, Samuels, and Ozer (2002, p. 73) did comment "Type membership predicted psychosocial functioning and ego resiliency and

control, but only because it summarized trait standing; dimensional trait measures were consistently better predictors. Nevertheless, while the types do not refer to distinct, homogeneous classes of persons, they do have utility as convenient labels summarizing combinations of traits that relate to important outcomes."

Saville et al. (2009, p. 741) correlated the MBTI with the Wave Professional Styles thirty-six dimensions. Their results suggest the MBTI may be measuring a narrow sub set of the Wave dimensions. Of the thirty-six dimensions, only ten correlated above 0.4 or below -0.4 with the MBTI. Eight of the ten correlations were consistent with previous research by McCrae and Costa (1989, p. 30) which mapped the four MBTI scales onto four of the Big Five, and two of the ten correlations were with MBTI scales different to McCrae and Costa's findings. The consistent correlations were as follows:

i. Wave's Openness dimension of "Inventive" correlated 0.51 with the MBTI instrument's Sensing to Intuition.
ii. Wave's Conscientiousness dimensions of "Reliable", "Conforming" and "Organised" correlated with the MBTI's Perceiving to Judging at 0.48, 0.48 and 0.64 respectively.
iii. Wave's Extraversion dimensions of "Interactive", "Engaging" and "Articulate" correlated with the MBTI's Introversion to Extraversion at 0.71, 0.65 and 0.47 respectively.
iv. Wave's Agreeableness dimension of "Attentive" correlated with the MBTI's Thinking to Feeling at 0.47.
v. Wave's Neuroticism is reversed to "Emotional Stability", and none of the dimensions correlated above 0.4 or below -0.4 with any of the MBTI scales.

The inconsistent correlations were as follows:

Firstly, Wave's Conscientiousness dimension of "Conforming" correlated with the MBTI's Sensing to Intuition at 0.49. This is likely to be due to correlations between Judging / Perceiving and Sensing / Intuition as reported by Johnson and Saunders (1990, p. 561) who commented "Consistent with previous findings, the correlation

between the S/N and J/P factors was found to be moderately high, with an estimated true correlation of 0.59."

Secondly, Wave's Openness dimension of "Analytical" only correlated 0.11 with the expected MBTI Sensing to Intuition scale. It also correlated -0.41 with the MBTI's Thinking to Feeling scale. A further examination of the Wave technical manual (Saville et al., 2009, p. 731-736) also revealed that the Wave Openness dimension of "Analytical" correlated as expected with the Hogan Personality Inventory's Openness HIC of curiosity at 0.41, and with the NEO-PI-R Openness facet of Ideas at 0.42. Sense can be made of this correlation when reference is made to Jung's (1921) definition of Thinking which did include a desire to analyse and think logically which is a likely reason the MBTI placed items to measure it in its Thinking scale rather than its Intuition scale. This is further supported by the MBTI Thinking to Feeling scale correlating 0.25 with the adjective "Logical" from the Adjective Check List (Schaubhut et al., 2009, p. 11) in another concurrent validity study.

The practical case for the use of typing models by Human Resource practitioners is also made well by Sava and Popa (2011, p. 380) who suggest "using personality types does have its utility in that the convenient labels used to summarize combinations of traits make sense to many practitioners as well as to naïve specialists working in human resources and in clinical contexts, even if such labels might have less predictive power than an approach using traits (Costa et al., 2002; Roth and von Collani, 2007)."

Finally, there is also evidence Jung did not intend his concept of type to be absolute when he said "there is no such thing as a pure extrovert or a pure introvert. Such a man would be in the lunatic asylum. They are only terms to designate a certain penchant, a certain tendency. For instance, the tendency to be more influenced by environmental influences, or more influenced by the subjective fact—that's all. There are people who are fairly well balanced and are just as much influenced from within as from without, or just as little" (Evans, 1979, p. 96). This does offer some evidence to suggest Jung may have viewed Introversion / Extraversion as operating on a continuum, rather than being bimodal.

2.3.7 Identifying Types in Big Five Data

The application of typing models is much more prevalent in the person-centred approach to psychology. When considering an individual's type, a person-centred practitioner typically pays attention to the qualities that emerge in the interaction between the factors that make up a type. For example, individuals high on Agreeableness in the Big Five are commonly also assessed as Feeling types in Jung's typology (McCrae and Costa, 1989, p. 30) and would typically be described as "friendly". However, Jung's "Extraverted Feeling" type is likely to be seen as more friendly than an "Introverted Feeling" type due to the interaction between the individual's Agreeableness / Feeling preference and their Extraversion. The ability to highlight additional information based on the interaction of factors is one reason some person-centred practitioners favour a typing approach. However, despite trait and typing approaches coming from different traditions in psychology, the Big Five has been successfully used to both create different typologies through combining different Big Five factors at each polarity and also to empirically test for the existence of types (Sava and Popa, 2011).

Analysis of other types derived from Big Five data can be found in Asendorpf, Borkenau, Ostendorf, and Van Aken (2001) who found evidence of three types in the data. Block and Block (1980) proposed a typology based on "Ego resiliency" (how adaptable one is to changes and pressures in the environment) and "Ego control" which ranges from impulsive / dramatic behaviours to controlled / undramatic behaviours. Building on this work, cluster analysis has been used to identify three types, namely:

i. The resilient type, as identified by above average scores on Openness, Conscientiousness, Extraversion, Agreeableness and Emotional Stability (reversed Neuroticism)

ii. The over controlled type, as identified by high scores for Conscientiousness and Neuroticism, and low scores for Extraversion

iii. The under controlled type, as identified by high scores for Extraversion and Neuroticism, and low scores for Agreeableness and Conscientiousness

Sava and Popa (2011) have further developed the typing approach and validated the above three types, as well as a variant of it containing five types, namely:

i. The under controlled type – High Extraversion and Low Conscientiousness

ii. The strain type – High Extraversion, Openness, Neuroticism, Conscientiousness, and Low Agreeableness

iii. The resilient type – High Openness, Conscientiousness, Extraversion, Agreeableness and Low Neuroticism

iv. The over controlled type - High Conscientiousness and Neuroticism, and Low Extraversion

v. The passive type – High Agreeableness and Low Neuroticism, Extraversion and Conscientiousness

2.3.8 Blending Factors - Circumplex Models

Jolandi Jacobi created a circumplex (see Figure 2-2) to display Jung's ideas in *"The Psychology of Jung: An introduction with illustrations"* (Jacobi, 1943, p. 16) and mapped Thinking / Feeling on one dimension versus Intuition / Sensing on another. The space between the axes were named as blends of the Jungian preferences.

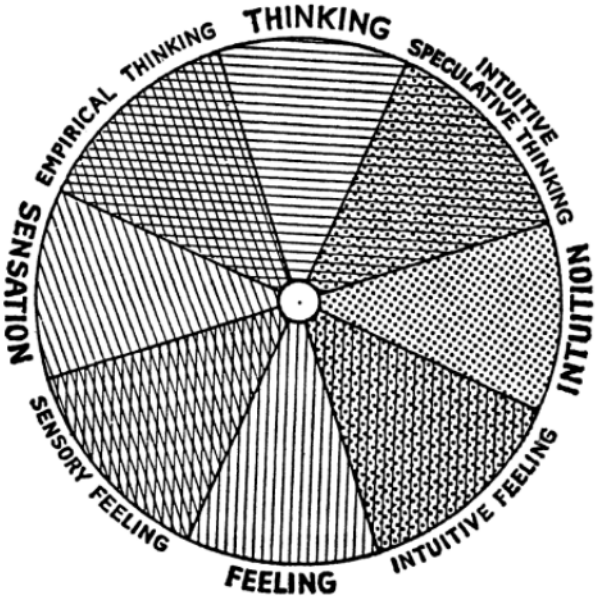

Figure 2-2: Example of circumplex for Thinking / Feeling and Intuition / Sensing (Jacobi, 1943, p. 16). Permission to reproduce this image granted by Yale Representation Limited.

In measuring personality in the 1950s, Timothy Leary asked, “What and how many are the dimensions along which the variables are to be scaled?” (1957, p. 64) and expressed his preference for a two-factor circumplex model stating, “We cannot doubt that more formal systems will eventually add new spatial dimensions to the organisation of personality. For the present, however, a two-dimensional space offers sufficient complexity for the data and more than a sufficient complexity of methodological problems.” (Leary, 1957, p. 64). Leary went on to use “love” and “social status” as the two axes of his circumplex.

Wiggins, Trapnell and Phillips (1988) referenced Leary’s ideas when they created the two factor Interpersonal Adjectives Scales model. Hofstee, De Raad and Goldberg (1992) combined these circumplex ideas with the Big Five forming the “Abridged Big Five Dimensional Circumplex” (AB5C), explaining that “the taxonomy of personality traits was developed, consisting of the 10 circumplexes that can be formed by pitting each of the Big Five factors against one another.” (p. 146). Figure 2-3 is an adapted form of the AB5C circumplex (Mitchelson, Wicher, LeBreton & Craig, 2009, p. 615). The AB5C model was in part developed in response to Goldberg highlighting the need for a periodic table of traits (Goldberg, 1981). This request has now been met, as a circumplex is ideal for exploring a scale’s primary and secondary factors in order to explore the space between factors (Woods, 2003). Woods (2003) has successfully used the circumplex approach to create a comprehensive “Periodic Table of Personality” based on combinations of the top two factors a scale loads on (Woods, 2003). The example in Figure 2-3 has been adjusted to show the Big Five equivalent of the Jungian preferences (McCrae & Costa, 1989, p. 30) expressed in the same corresponding location on the circumplex as in Figure 2-2.

In the Periodic Table of Personality, different combinations of factors are given different names. For example, A-O+ is termed ‘Self-reliance’ and the opposite A+O- is termed ‘Nurturance’. O+A- has been named ‘Critical Enquiry’ and its opposite O-A+ ‘Rule conformity’ (Woods & Anderson, 2016, p. 70).

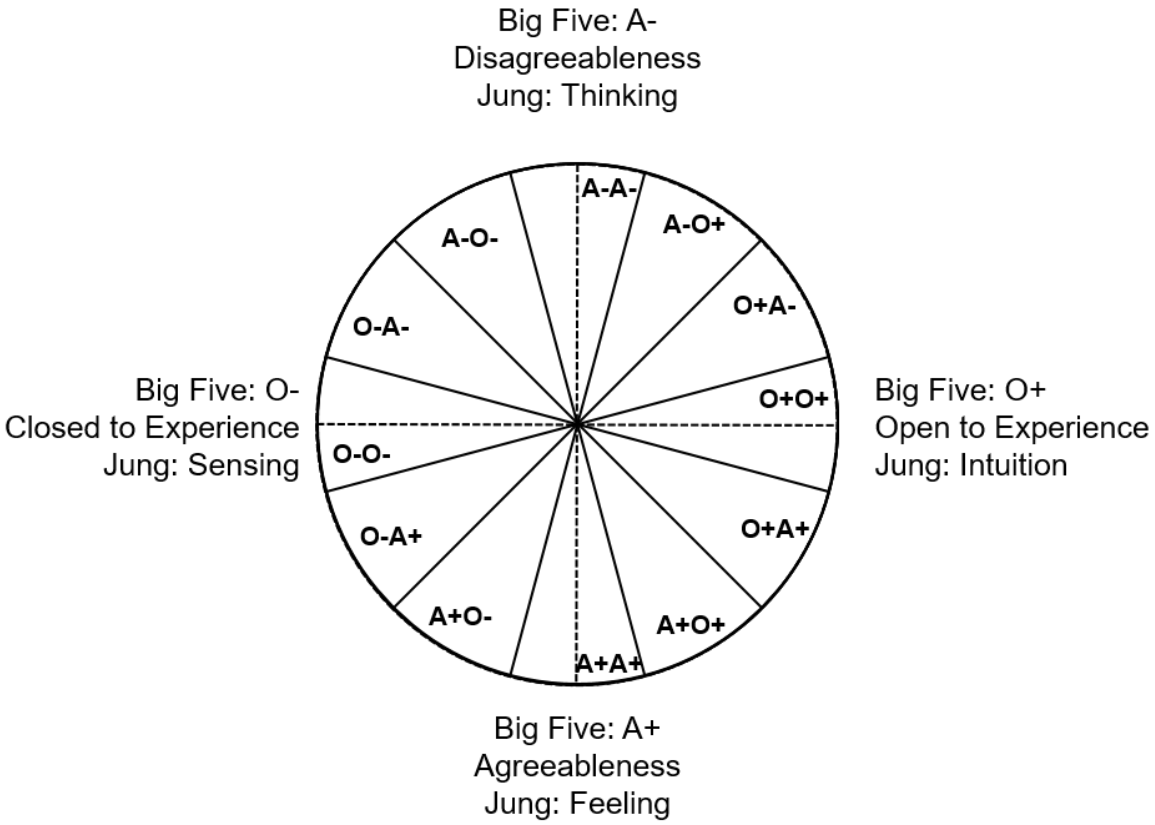

Figure 2-3: Example of circumplex for Disagreeableness / Agreeableness and Open to Experience / Closed to Experience

In addition to supporting the formation of a periodic table of traits, visualising personality as a circumplex is a semantic representation that opens up different ways of conceptualising personal change as well as being an innovative way to examine issues of predictive validity.

2.3.9 Conclusion on the Origins and Evolution of the Big Five

The origins and the pros and cons of the different theories underpinning the Big Five and the variations of it may be debated, but the benefit to researchers of having such an overarching framework cannot be understated.

Before the advent of the Big Five framework, earlier reviews on the validity of personality in predicting job performance have been ambiguous and difficult to compare (Woods, 2003). With a well-accepted framework, results can now be compared and the accumulation of a body of knowledge accelerated.

This thesis aims to build on this evolving body of knowledge and enable better understanding of the facets underneath the Big Five and the link between them and performance at work. The gaps in knowledge in measuring these facets are well documented and there are many calls for further research in this area that this thesis is responding to. “Identifying narrow predictors for specific outcomes with incremental validity above the Big Five as a criterion is a research endeavour only now really getting underway.” (Ozer & Benet-Martinez, 2006, p. 403). This research is part of that endeavour and one of its unique contributions involves exploring the facets underneath the Big Five through measuring both ends independently, and through measuring both poles adaptively and maladaptively.

2.4 Measuring Personality Factors

2.4.1 Item Content

For the last hundred years, personality has often been measured using self-report questionnaires that measure personality indirectly. This is typically based on self-report items in which a user scores their thoughts, feelings and behaviours. By contrast, thoughts and feelings are much harder to measure through 360-degree observations. Consequently, it is typically the behavioural component of personality that is measured when using 360-degree observer feedback.

The approach to developing questionnaires based on thoughts, feelings and behaviours was pioneered by Cronbach and Meehl (1955) and their approach is still very relevant to the practice of psychometrics today. However, one unresolved issue in item creation is the extent to which items should measure personality inferentially or transparently. For example, the item from the Hogan Personality Inventory, (sometimes shortened in the literature to HPI) “I would like to be a racing car driver” (Hogan & Hogan, 2007, p. 26) is inferentially measuring Openness, whereas the Saville Wave item “very thorough” (Saville et al., 2009, p. 135) is transparently measuring Conscientiousness. The choice of approach may well depend on the context in which the instrument is being applied, the degree to which the context is high stakes for the test taker, and how much the test designer needs to hide what is being measured from the test taker.

2.4.2 Impact of the Internet and Social Media

There were early concerns about the ability of researchers to validly generalise results from internet samples (Buchanan & Smith, 1999) and Saville et al. (2009) have sometimes compared and contrasted data gathered over the internet "unsupervised" with data gathered "under the supervision" of a psychologist. In practical terms, the differences are small and with the huge growth in access to and use of the internet, interest has turned towards measuring personality in a very specific context, such as via an individual's digital footprint. Researchers are now identifying how digital footprints can potentially produce valid measures of personality. These studies are promising and merit further research.

Bachrach, Kosinski, Graepel, Kohli, and Stillwell (2012) have created a multiple regression that aims to predict an individual's Big Five scores based on their Facebook activity such as an individual's number of friends, number of associations with groups, the number of "likes" they gave out, the number of photos they uploaded, the number of status updates they made and the number of times others "tagged" them. The best r squared values were for Extraversion at 0.33 and Neuroticism at 0.26.

Chittaranjan, Blom, and Gatica-Perez (2011) correlated the Big Five with statistics on smartphone usage such as the number and duration of calls and the length of usage of the internet. Although the sample size was only 89, they did find many statistically significant results such as high Extraversion correlating negatively with high internet usage with $r = -0.26$, and high incoming call duration correlating with Extraversion with $r = 0.2$.

2.5 Big Five Validities

Earlier work by Ghiselli (1966), Korman (1968) and Schmitt, Gooding, Noe and Kirsch (1984) found average validities of the order of 0.2, which they judged to be low. They also found many negative correlations between personality and job performance. They came to the conclusion that personality models comprised unstable sets of traits and were not optimistic such models could be usefully applied in organisations.

Guion and Gottier (1965, p. 158) concluded that “The rawest form of situational empiricism, despite growing unrest with it, still seems to result in better prediction than more sophisticated psychological theory”. They went on to say, “it must be concluded that, taken as a whole, there is no generalizable evidence that personality measures can be recommended as good or practical tools for employee selection.” (Guion & Gottier, 1965, p 159).

This research was later built on by Mischel (1968) who proposed that behaviour is in fact inconsistent. Nevertheless, there were dissenting voices in this era such as Norman (1967) who continued to work on developing the Big Five taxonomy when it was less fashionable to do so. Building on Norman’s research, Barrick and Mount (1991) grouped personality variables under the Big Five personality dimensions that were first outlined by Tupes and Christal in 1961 (Tupes & Christal, 1992). Barrick and Mount (1991) were initially able to show generalisable validity for two factors across different types of criteria; Conscientiousness had a corrected mean criterion validity coefficient of 0.22 and Extraversion of 0.13. Salgado (1997) replicated the study in a European sample and found generalisable validity for the Conscientiousness and Emotional Stability factors. Hough, Eaton, Dunnette, Kamp, and McCloy’s (1990) findings were also consistent with these results.

Robertson and Kinder (1993) found when *a priori* hypotheses of personality facet correlations with specific competencies were tested, they produced stronger validity coefficients than studies that averaged all scales and then correlated them with competencies without any *a priori* hypotheses. They concluded that “… earlier meta-analytic research, based on averaging procedures, might have underestimated the validity of personality variables” (p. 240).

Although there are still many critics, the Big Five framework now serves as a map for many researchers and it is typically used to position any personality variable found in the literature, thereby facilitating meta-analytic cumulation (Woods, 2003). Woods and Anderson (2016) liken the pre-Big Five era in psychology to chemistry in the Nineteenth Century in its pre-periodic table era. They have created a Big Five based “‘Periodic Table of Personality’ to allow researchers and practitioners to examine underlying structures of personality in greater clarity, depth, and accuracy” (Woods & Anderson, 2016, p. 30).

The meta-analytic cumulation the Big Five has enabled, has now provided the empirical cornerstones needed to build theories of work behaviour utilising personality constructs (Ones & Viswesvaran, 1996). It has allowed a clear understanding of how the interaction of traits function across occupational groups. For example, although Extraversion does not show generalisable validity across all occupations, the trait has been shown to be the most valid predictor of managerial performance with Barrick and Mount (1991) finding a mean corrected validity coefficient of 0.18 for Extraversion. Hough (1992) showed that potency (a trait under Extraversion) and achievement (a trait under Conscientiousness) both yielded an uncorrected mean validity coefficient of 0.18 for managers and executives. In a meta-analysis of managerial performance, Hough, Ones and Viswesvaran (1998) found that dominance under the Extraversion dimension was the best predictor of managerial performance (r = 0.27). Furthermore, a second-order meta-analysis of a century of research by Barrick, Mount, and Judge (2001) confirmed the generalisability of Extraversion as a predictor in managerial performance (r = 0.17) and Conscientiousness as the “g” factor of personality in predicting overall performance across jobs. A meta-analytic study by Judge, Bono, Ilies and Gerhardt (2002) showed that Extraversion is the best predictor of leadership among the five factors (r = 0.31).

By way of contrast, the research of Grant, Gino and Hofman (2011) highlights a “theoretically sound, empirically supported strategy whereby less extraverted individuals can facilitate group performance” and suggest this is because more introverted people are more likely to “actively encourage proactive behaviors on the part of employees” (p. 545). Further supporting the view that good leadership performance can be associated with more introverted traits, the research of Collins (2001) on leaders that took their businesses from “good to great” shows that “Level 5 leaders” are characterized by a combination of the opposite qualities “deep personal humility and intense professional will” (Collins, 2005, p. 69). Although these studies are promising, there is a lack of quantified criterion studies to relate such findings to the Big Five of leaders.

Woods (2003) summarises well the benefit of the Big Five as a unifying model enabling researchers to build on each other’s personality research, as well as

making a strong case for its validity and usefulness in the realm of selection and assessment in the workplace.

More recently, all five of the Big Five were shown to have significant validities with Organisational Citizenship Behaviours in a meta-analytic study (Chiaburu, Oh, Berry, Li & Gardner, 2011).

Some forty-six years after doubting the validity of personality at work (Guion & Gottier, 1965), the more recent works by Guion (2011) are largely supportive of the use of personality in selection.

Johnson (2004, p. 84) concluded “In early personality research, correlations were computed between all personality variables and all criteria. Most of these correlations were near zero, creating the impression that personality was generally unrelated to performance. We now better understand that the trait being investigated must be relevant to the criterion and that predictors and criteria should be conceptualized as constructs (Hough & Schneider, 1996)”.

From all the reviewed research work above, it can be concluded that the Big Five Model has been a positive force in that it has overturned earlier negative reviews and proved personality to be a consistent enough predictor of performance at work for it to be both a useful and parsimonious taxonomy.

2.6 Personality and Context

2.6.1 Does Personality Change Over a Lifetime?

Back in 1890 William James suggested that “It is well for the world that in most of us, by the age of 30, the character has set like plaster, and will never soften again” (James, 2013, p. 124). Since then, various studies have attempted to quantify the impact of age on personality. Indeed, Costa and McCrae’s original purpose in building the Big Five model was to better understand how personality changes through childhood. They and many other personality researchers do consider that after the age of 30, personality is fairly stable (Costa & McCrae, 1988; McCrae et al., 1999). Recent research on the development of individual differences in both cognition and personality suggests “stability of cognition nears its asymptote by the end of the first decade of life, whereas stability of personality takes three decades

to near its asymptote" (Briley & Tucker-Drob, 2017, p. 51). Costa and McCrae (2006) consider these changes in personality over time as small and largely due to the biological maturation processes.

Bleidorn, Kandler, Riemann, Angleitner and Spinath (2009) also found genetics to be an important factor in personality change over time. Their work also contrasted the impact of both genetic and environmental effects on personality change and they found some trait changes were more impacted by the environment than genetics (p. 142). For example, child sexual abuse has been found to be a major factor in most forms of psychiatric disturbance (Trickett, Noll, Reiffman & Putnam, 2001).

Allemand, Zimprich, and Martin (2008, p. 3) reported "older adults were, on average, more agreeable and, especially, more conscientious than middle-aged and younger adults. Findings from our study suggest that both continuity and change may mark personality over the course of life." Other studies have also found that in addition to increasing their Agreeableness and Conscientiousness as they age, people also typically become less Neurotic (Soto, John, Gosling and Potter, 2011). Furthermore, a longitudinal analysis by Boyce, Wood and Powdthavee (2013, p. 287) reported that "personality changes at least as much as economic factors and relates much more strongly to changes in life satisfaction. Our results therefore suggest that personality can change and that such change is important and meaningful".

Overall, it is still unclear as to what extent these effects arise from a biological aging process or are a cohort effect linked to the specific era and circumstances in which these group of people have aged. This cohort effect could include the active intentions and efforts of people to change aspects of their personality (Baumeister, 1994).

John and Srivastava (1999) concluded that although personality traits are stable over time, they nevertheless can change for an individual as a result of an intervention programme such as therapy. The practical implication of this is that "the links between the Big Five and important life outcomes points to behavioural domains that people can target for personal development and change" (John & Srivastava, 1999, p. 125).

Hudson and Roberts (2014) found evidence that the majority of people do indeed want to change some part of their personality. Hudson and Fraley (2015) went on to conduct longitudinal randomized experiments to establish if those people that want to change their personality traits are able to do so. They concluded “People not only want to change their personalities - they may be able to actually change their personality traits in desired ways. Moreover, psychological interventions appear to be able to catalyze the change process” (p. 17). Others have proposed that interventions based on coaching can help intentionally change personality (Martin, 2012).

2.6.2 The Case for Personality Being Inconsistent Across Situations

Mischel (1968) suggested that behaviours are influenced more by the situation than many personality psychologists are willing to admit. Shoda and Mischel (1996) asserted our behaviour is in fact inconsistent across situations and behaviour is largely dependent on the context. They suggest that ignoring the context in a research study is equivalent to averaging behaviours across different contexts and that this may be one reason personality models may show what they would judge to be low validities.

Recent studies such as Judge, Simon, Hurst and Kelley (2014) are also suggesting that personality is dynamic and responsive to outside demands and stimuli. For example, “Historically, organizational and personality psychologists have ignored within-individual variation in personality across situations or have treated it as measurement error.” (p. 199).

Fleeson and Jayawickerme (2015) support this viewpoint and quote Allport who said “To the situationist I concede that our theory of traits cannot be so simple-minded as it once was. We are now challenged to untangle the complex web of tendencies that constitute a person, however contradictory they may seem to be when activated differentially in various situations.” (Allport, 1968, p. 47 as cited in Fleeson & Jayawickerme, 2015, p. 82).

Furthermore, when critiquing the Big Five and HEXACO trait theory, Fleeson and Jayawickerme (2015) highlighted the shortcoming of a static view of personality

saying “Specifically, they do not provide a full account of how individual differences in traits are manifest in behaviors” (p. 85).

It is interesting to reflect that the magnitude of the raw correlations of behavioural measures with personality questionnaires rarely exceeds 0.3 (Woods, 2003), with many of the older studies reporting typical correlations smaller than this and seeing this as a reason to doubt the consistency of personality in different situations (Mischel, 1968). In contrast Costa and McCrae’s early work found correlations of 0.2 as evidence of the consistency of personality (Costa & McCrae, 1992a).

Judge (2012, p. 5) has referred to ‘The Cold War of Psychology’ and asked, ‘Why do organizational personality psychologists tend to ignore context when what they study is a fundamental context?’ and ‘Why do personologists – at least those who study context – tend to ignore one of the more fundamental contexts: work?’

This thesis intends to play a part in bringing together these two perspectives. In part, this is attempted through measuring the five Big Five measures at each polarity separately, and in adaptive and maladaptive forms, allowing traits within an aspect of personality to be measured in four different ways.

2.6.3 The Case for Consistent Behaviour Across Situations

By way of contrast, trait theory focusses on the consistent behaviour displayed by an individual across both a lifetime and in different contexts. Here we view the context and the individual’s moods as transient factors that create noise in the data, yet underneath this noise individuals possess consistent and stable traits that can be used to predict performance.

2.6.4 The Case for Stable Traits Moderated by the Situation

Personality is considered to be multifaceted and reflected in our internal thoughts, feelings, and preferences as well as in our actions and behaviours. As Funder (2001, p. 2) states: “Personality refers to individuals' characteristic patterns of thought, emotion, and behaviour, together with the psychological mechanisms -- hidden or not -- behind those patterns. This definition means that among their colleagues in other subfields of psychology, those psychologists who study personality have a unique mandate: to explain whole persons.”

Others have also highlighted this important distinction and suggested it is possible we may have stable traits, yet their behavioural manifestation is moderated by the situation. Barrick and Mount (2005) reported that validities are higher when the situation did not mandate a specific behaviour. “When situations are exceptionally strong, all individuals tend to behave in the same way regardless of their personality traits. As a result, strong situations have been shown to decrease the observed relations between personality and behavior. In contrast, weak situations are characterized by few expectations, or many ambiguous demands, and consequently individuals have considerable discretion in how to behave.” (p. 749).

As such, understanding the interplay between internally held components of personality, and personality as manifested in behaviour is explored in this research in order to understand personality in terms of the whole person, as advocated by Barrick and Mount (2005, p. 369) “Personality traits are enduring, distal forces that influence behavior, but there are both mediating and moderating variables that must be accounted for to adequately explain the effects of personality on human behavior”.

Indeed, many Big Five measures of personality include not only items pertaining to preferences (including feelings and beliefs), but also items describing behaviours (and the actions we are seen to take). However, one criticism is that many of the Big Five measures are limited in their ability to distinguish between preferences and behaviours. McAdams (1995) highlighted the need to separately measure aspects of personality that are more privately held versus those that are observable. Big Five models that combine these preferences and behaviours into one measure risk overlooking interesting insights into how an individual’s traits are manifested.

Big Five instruments such as the Trait Descriptive Adjectives (TDA) are lexical and as such do not measure any particular behaviour. By way of contrast, Buss and Craik (1981) developed the Act Frequency Approach (AFA) to measuring personality based on the frequency with which a behaviour occurs within a specific time period. In this approach, the behaviour must be observable, although the questionnaire is still a self-report and not based on actual observations. The AFA therefore does not measure any internal state, preference, feeling or belief. Given most definitions of personality include both internal states (e.g. thoughts, feelings

and beliefs) as well as behaviour, the AFA has been criticised by Block (1989) as being too reductionist. Nevertheless, the very different TDA and AFA approaches do highlight well two important aspects of personality, namely the internal aspects versus the observable behaviours.

Recent studies correlating observable behaviours with the TDA have found "moderate, but not high convergence with a traditional trait-descriptive adjective measure" (Chapman & Goldberg, 2017, p. 204) which suggests more research is needed to understand the process by which traits become manifest in behaviours.

Many instruments combine both approaches, yet without measuring the differences. For example, in the NEO-PI-R (Costa & McCrea, 1992a) an individual's score on Neuroticism is derived from items pertaining to preferences, feelings and beliefs such as "I rarely feel lonely or blue". However, it is also based on items pertaining to behaviours such as "I rarely overindulge in anything" (Costa, McCrae, Rust & Lord, 2006). Combining such items into one measure does not help us understand the degree to which an individual may hold neurotic feelings as opposed to exhibiting neurotic behaviours in a given context. McAdams (1995) also suggested many Big Five measures do not consider behaviours that are domain-specific. For example, some behaviours may only manifest in a very specific context, or in a certain place, or when performing a certain role.

The Big Five approach also typically measures traits on a single continuum; thus, to be high at one end of the continuum, implies being low on the other end. However, researchers have argued that each individual has the capacity to move along each dimension as circumstances (social or temporal) change (Fleeson, 2001). This suggests an individual is not simply one thing or another (e.g. an extravert), but often a blend of opposing traits, albeit exhibiting some characteristics more than others within different contexts (Fleeson, 2001). In this sense, our natural disposition and preferences influence our behaviours; however, they do not define them.

Others who support the view that intra-individual variation in the expression of personality traits needs further research include Heller, Komar and Lee (2007, p. 898) who suggest "short-term variability in personality has been treated predominantly as error variance, rather than as meaningful intra-individual dynamics" and "Personality states are the counterparts of personality traits. That is, they are

short-term, concrete patterns of acting, feeling, and thinking compared to the more abstract and enduring trait conceptions." (Heller et al., 2007, p. 899).

Heller, Perunovic and Reichman (2009) suggest much personality research has been top down, and assumed the stability of traits over time. They research using a bottom-up approach to trait state measurement and suggest the aggregated effect of trait states over time can shape an individual's personality traits.

Indeed, although behaviour patterns are influenced by individual preferences, they are also influenced by many other things such as the culture in which individuals operate, attitudes, values, beliefs, self-awareness, experiences etc. This thesis employs items based on both inherent preferences and actual behaviours, but has not sought to create separate measures for them. The need for this separation has been highlighted by McAdams (2001) and to some extent operationalised by Saville et al. (2009) in the Wave instrument. This is discussed later in this thesis as a promising direction for future research that may build on this research, in particular, to explore how preferences and behaviours within personality may relate to external measures of work effectiveness.

This thesis also explores how dispositional preferences may be managed and sometimes tempered to avoid extreme use of Big Five traits, which may be an important factor in performance at work in certain contexts. This is in part inspired by Hogan et al.'s (2010) finding that leadership derailment was often caused by a leader's inability to manage their behaviour in the face of difficult circumstances.

2.7 Some Issues with the Big Five

2.7.1 The Big Five Bandwidth Fidelity Argument

One of the rationales for using a hierarchical Big Five model is that it simultaneously abides by the scientific principle of parsimony, also known as Ockham's Razor, at the broad-bandwidth five factor level, and also provides improved predictive validity through narrow-bandwidth lower order facets (Goldberg, 1999).

Much research has highlighted the academic consensus at the broad-bandwidth level of the Big Five (O'Connor, 2002). However, at the narrow-bandwidth level there is no such consensus yet with Ziegler, Booth and Bensch (2013, p. 160) suggesting

“for most traits there is no common agreement about the number and nature of such facets” and calling for more work to be done in this area. Pace and Brannick (2010, p. 675) suggested “mean correlations from meta-analyses in which a wide variety of personality tests are grouped into categories by the Big Five (or other taxonomies) may not be as meaningful as desired”.

In both commercial and research settings, different Big Five personality models use different traits to measure the same higher order personality constructs. However, sometimes traits from different personality models that appear to measure the same construct actually have low correlations and this can bring into question what they are actually measuring (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006; Brackett & Mayer, 2003; Ziegler, Booth & Bensch, 2013).

This suggests some Big Five facets created by different test designers may suffer from the “jingle fallacy” (Corsini, 1999, p. 514) where similarly named facets may measure different things or the “jangle fallacy” (Corsini, 1999, p. 513) where facets with different names may in fact be measuring the same things. This research includes concurrent validity studies to explore how the new traits measured correlate with industry standard measures to mitigate the possible impact of the jingle / jangle fallacies. Furthermore, the impact on workplace performance of each polarity becoming maladaptive is also researched.

Salgado, Moscoso and Berges (2013, p. 74) made the case for measuring at the Big Five high level rather than the facet level and found in a study on 226 Spanish police officers “Conscientiousness predicted the three criteria (true validities of 0.25, 0.28 and 0.37, respectively) and that the facets neither predicted job performance nor showed incremental validity over Conscientiousness”. In response to this, Ashton, Paunonen, and Lee (2014, p. 24) demonstrated with 282 Canadian students that lower levels facets provide better predictive validity than five factor level measures for predicting delinquency. They also make good use of confirmatory factor analysis to show this validity benefit is based on trait variance and finally concluded that “that exclusive reliance on broad factor measures can be counterproductive for understanding and predicting behavior.”

2.7.2 Preferences vs Behaviours

It is possible that distinguishing between preferences and actual behaviours may improve the Big Five's ability to predict outcomes. Critiques of the Big Five's ability to predict outcomes are well documented (Morgeson, Campion, Dipboye, Hollenbeck, Murphy & Schmitt, 2007) and often focus on what they perceive to be low correlations between the Big Five and workplace behaviours. A concern within the literature is that these disappointing relationships are in part due to the fact that the Big Five may be too general a measure and may oversimplify the often-complex nature of these relationships. Consequently, some researchers call for broad Big Five measures to be used to predict broad performance measures, and the use of narrower measures of personality to predict more specific or contextual performance.

For example, Ones and Viswesvaran (1996) vigorously argued for the use of broad constructs of personality such as the Big Five in predicting overall performance. Compound variables that Ones and Viswesvaran (2001) termed as "Criterion-Focused Occupational Personality Scales" (COPS), such as measures of integrity and measures of customer service, appeared to have substantial predictive validity in overall performance. The COPS were shown to cover Digman's (1997) Alpha factor, consisting of Conscientiousness, Agreeableness, and Emotional Stability (Ones & Viswesvaran, 2001).

Other researchers lend support to the idea that narrow traits can often explain more of the variability in work performance than broader constructs. For instance, Ashton (1998) presented evidence that the two narrow scales of "responsibility" and "risk taking" yielded higher validities than the broader construct of "integrity". Similarly, Paunonen and Ashton (2001) found evidence to show that narrow facets achieved greater validities than broad constructs of the Big Five in predicting performance reporting "The narrow facets, therefore, were able to substantially increase the maximum prediction achieved by the broad factors. The results of this study are interpreted as supporting a more detailed approach to personality assessment, one that goes beyond the measurement of the Big 5 factors alone." (p. 524).

Researchers are calling for more emphasis on examining the relationships between the lower-order facets of personality and specific outcomes to get a much richer picture of the nature of these relationships (Paunonen & Ashton, 2001). More

recently, Bergner et al. (2010) made the case for further research into lower order "facets" validities in Extraversion, Neuroticism, Agreeableness and Openness. This thesis is, in part, a response to such requests for more research.

2.7.3 The Need for Lower Order Facets

There is evidence to suggest that the Big Five is not broad enough to cover all the constructs of personality (Hough & Ones, 2001). Hough (1992), Hough et al. (1990) and Hough and Ones (2001) found that the Big Five personality dimensions were inadequate as a taxonomy to predict and explain performance in a consistent manner. Hough and colleagues pointed out that in two dimensions of the Big Five, some factors correlate positively and some negatively with the same external criterion of work performance. For example, Hough (1992) found that, under the Extraversion factor, sociability correlated negatively with managerial performance while dominance or potency correlated in a strong positive manner with this criterion. Similarly, under the Conscientiousness factor, dependability correlated negatively with managerial performance while achievement was positively associated with the criterion. These patterns of correlations were further confirmed in a large meta-analysis on managerial performance by Hough et al. (1998) where dominance was the strongest predictor of managerial performance ($r = 0.27$) yet sociability negatively correlated with performance ($r = -0.02$). Likewise, for the Conscientiousness dimension, dependability was insignificant in the prediction of managerial performance while achievement correlated positively with $r = 0.17$.

Tett (1998) found many bidirectional relationships between personality constructs and work performance. Tett (1998) suggested that researchers have largely ignored these patterns of correlations and that they occur too often to be attributed to spurious findings. Hough (1992) found measuring Extraversion based on aggregating sociability (negatively correlated with some workplace performance) with potency (positively correlated) diluted the validities. A later study by Hough and Oswald (2000) found similar validity diluting effects across all of the Big Five factors when examining lower order facets.

2.7.4 Addressing the Issues with the Big Five

Based on the bi-directional pattern of correlations of some constructs of the Big Five model of personality under the same factor, Hough (1992; Hough et al., 1998; Hough & Ones, 2001) construed that these constructs cannot be measuring the same thing and extended the Big Five into nine dimensions. For Extraversion, potency and affiliation are separated, and for Conscientiousness, dependability and achievement are also separated.

2.8 Big Five Measurement Bias

2.8.1 Researching and Measuring Both Poles of the Big Five

Another characteristic of typical Big Five models is that they measure traits across a continuous spectrum, often focusing on the measurement of one end of the scale. One end of the scale may well be seen as more socially desirable than the other.

In clinical settings, the personality disorder trait model is used and recently it was found also to have five factors (Thimm, Jordan & Bach, 2016). Only one end is maladaptive for four of the five dimensions, namely “negative affectivity”, “detachment”, “antagonism”, and “psychoticism”. “The traits represent the maladaptive extremes of normally distributed continua, and the opposite extremes are generally adaptive.” (Pettersson, Mendle, Turkheimer, Horn, Ford, Simms & Clark, 2014, p. 1). The fifth factor, “disinhibition versus compulsivity”, measures maladaptive behaviours at both ends. Pettersson et al. (2014) went on to measure both ends adaptively and maladaptively in order to create a new evaluatively balanced instrument.

Indeed, an inspection of introverted items in models such as the IPIP-NEO-120 shows they are often reversed Extraversion items that measure Introversion in quite extreme and less socially desirable forms. For example, IPIP-NEO-120 items measuring reversed Extraversion include: “Avoid contacts with others” and “Wait for others to lead the way” (Johnson, 2014, p. 81).

Some instruments devote all their items on a Big Five scale to positive and socially desirable measures, and do not measure the opposite scale with any items. For example, the Saville Wave (Saville et al., 2009) Extraversion scale is termed

“influence” and is measured by 54 items all positively measuring Extraversion, with no reversed items or items directly measuring Introversion in the model.

Furthermore, typical output reports from Big Five questionnaires often describe one end of the polarity in a more socially desirable way, and the other ends less positively. For example, the PAPI 3 report (Sanz, Gil, Barrasa & García-Vera, 2006) describes a person low in Conscientiousness as not enjoying planning and likely to leave this to others, as opposed to being structured and ordered. A low Extraversion individual is described as somebody who does not see spending time in the company of others at work as important, as opposed to being energetic and sociable.

Indeed, this raises the question of whether Big Five measures may sometimes incorporate an element of bias in favour of one end of certain traits. Cain (2013) highlights the perceived Western bias for Extraversion over Introversion, with Introversion often being seen as simply a lack of Extraversion.

Even those instruments that do measure Introversion directly, do not often measure the many positive tendencies associated with Introversion such as being observant, thinking before speaking and listening before advocating (Cain, 2013; Grant, 2013; Laney, 2002). Similarly, such models could also underestimate the degree to which people who score high on Extraversion may also demonstrate these effective introverted behaviours in a different context.

Indeed, without distinguishing between inherent preferences and behaviours in specific contexts, a report on a measure could be in danger of overinflating or underinflating scores, through inferring the relationship between levels of preferences / traits and actual behaviours. For example, it may be assumed that somebody highly introverted may avoid socialising. However, could somebody who is introverted by preference still be very effective at certain extraverted behaviours in specific contexts such as public speaking or being assertive if employed in a managerial role?

McCrae and Costa (1989) found the majority of individuals are somewhere around the middle of the trait spectrum. This research explores the idea that some of these individuals who score around the midpoint could be high on both ends of the spectrum in different contexts.

This research seeks to explore and quantify these relationships, and looks to establish how much people tune up or develop certain behaviours within their daily lives. Hence the questionnaires developed in this research allows an individual to measure themselves against opposing behaviours independently, and allow them to be both in different contexts. In this way, measuring both ends of the Big Five polarities creates ten measures.

Furthermore, this thesis seeks to explore the correlations with workplace performance of each polarity.

Taking Conscientiousness as an example, this enables this research to measure the benefit of low Conscientiousness as well as the benefit of high-Conscientiousness. For example, a low Conscientiousness individual may be viewed as careless, yet they also could benefit from them being more flexible and spontaneous. This research allows for the possibility that an individual could be both high and low on Conscientiousness in different contexts.

2.9 The Bright Side and Dark Side of Personality

2.9.1 Potential Impact of Extreme Big Five Traits on Performance

Interestingly, findings from recent research do shed light on one potential reason why the predicted relationships between certain traits and outcomes are often considered low and vary across studies (Furnham & Fudge, 2008; Warr, 2002; Grant, 2013). Big Five researchers have sometimes not considered the potential detrimental effect of possessing very high levels of a trait. Instead, it is often assumed that the relationship between the degree to which an individual possesses a trait, and the resulting outcome, is linear. Take for example, the common assumption that extraverts make the best salespeople (Altemeyer, 2011). It is natural perhaps, to assume, that Extraversion would be a reliable predictor of sales performance. Yet research from three large meta-analyses that included over 3,800 salespeople, shows that the average correlation between Extraversion and sales performance is as low as 0.07, and not significantly different from zero (Barrick, Mount & Judge, 2001). Furnham and Fudge (2008) found the relationship to be non-significant and suggested it may be possible to inhibit performance with too much Extraversion. Warr (2002) has also suggested this.

More recent evidence does indicate that, actually, too much of good thing can be a bad thing. Indeed, research has actually discovered that the relationship between traits and outcomes can be curvilinear (Grant, 2013).

Guion (2011) also urges researchers to look for nonlinear relationships when seeking to establish validities. That is, increased levels of a trait correlate with an outcome, but only up to a certain point, where upon the outcome starts to decrease (creating an inverted U curve). This phenomenon has been shown across a number of traits and outcomes, including Conscientiousness and task performance (Le, Oh, Robbins, Ilies, Holland & Westrick, 2011), Emotional Stability and organisational citizenship behaviour (Le et al., 2011) and Extraversion and sales revenue (Grant, 2013). This suggests that it is not enough to merely measure the strength of a trait, as this could be considerably undervaluing the detrimental impact associated with very high levels of the trait. Indeed, this research attempts to challenge the 'more is always better' assumption in the way that traits are often linked to outcomes. Rather, measures of personality should endeavour to distinguish behavioural tendencies that are considered effective from extreme behavioural tendencies that could be detrimental to performance.

In the personality literature, the thread of research covering helpful personality traits and also extreme personality characteristics is often referred to as "bright side" and "dark side" traits of personality. For example, Hogan and Holland (2003) used the "bright side" of personality to predict performance. However, some researchers recommend expanding the domain to include undesirable dispositions variously described as counterproductive, sub-clinical and dysfunctional, collectively referred to as the "dark side" (Benson & Campbell, 2007; Hogan & Hogan, 2001). "Dark side" traits have been called "overriding personality defects". There is some debate as to the strength of this claim as Kurz, Saville and MacIver (2010) showed that the Hogan Development Survey (HDS), which measures the "dark side" of personality had in fact more positive correlations with the Saville Consulting Wave Personality Measures than negative ones.

Nevertheless, Harms, Spain and Hannah (2011) argue that "dark side" traits can provide incremental validity over the "bright side" traits of the Big Five model in predicting leadership behaviour and performance criteria. That is to say, the "bright

side" shows validity, but when used in tandem with the "dark side", produces stronger relationships with performance.

The HDS measures eleven "dark side" traits and a correlation of these traits with the seven Hogan Personality Inventory scales (Hogan & Hogan, 1997, p. 37) shows six of the seven HPI scales correlate positively and negatively with at least one of the HDS eleven scales. However, interestingly, the "Adjustment" (reversed Neuroticism) scale in the HPI correlates negatively with all eleven HDS scales, ranging from r = -0.12 to r = -0.71, suggesting Neuroticism may have a particularly significant role in helping to understand dark traits and maladaptive behaviour.

Finally, two individuals could both score equally highly on what could be considered 'bright side' or adaptive Extraversion, yet one of them may also score highly on 'dark side' or maladaptive Extraversion. In terms of inhibiting performance, it may be the case that the individual with maladaptive Extraversion could be over aroused (Zuckerman, 2014) and inhibit both their own and other people's performance. Consequently, there is a case for measuring a maladaptive form of a trait, rather than making the common assumption that high levels of an adaptive trait imply the emergence of maladaptive behaviour. This lends weight to the approach adopted in this thesis whereby Big Five traits are measured adaptively as well as in a "too much of a good thing" (or maladaptive) form. It also supports the case for this research not finding it necessary to adopt a clinical approach based on mental disorders to explore the impact of these behaviours at work.

Nevertheless, given that other instruments such as the HDS (which are used in this research for convergent and divergent validity purposes) have their origins in a mental health model, it is useful to review the literature concerning the links between Big Five traits and personality disorders. The next section covers some of the research on this.

2.9.2 Extreme Big Five Traits and Personality Disorders

The Diagnostic and Statistical Manual of Mental Disorders has recently defined personality disorders in terms of dysfunctional personality traits, in part to address criticism of the previous categorical approach as strong evidence was gathered by Krueger and Eaton (2010) demonstrating the superiority of measuring dysfunction

via continuous traits rather than assigning an individual to a categorical type. Consequently, the new Personality Inventory for DSM-5 measures pathological personality traits. Researchers have sought to correlate these measures with various Big Five non-pathological measures. For example, in a Norwegian sample, Thimm, Jordan and Bach (2016, p. 6) found significant correlations based the 220 item DSM-5 (PID-5) and the 44 item "Big Five Inventory" (BFI) showing the following key correlations:

i. Negative affectivity and Neuroticism with r = 0.77
ii. Detachment and Extraversion with r = -0.69
iii. Antagonism and Agreeableness with r = -0.48
iv. Disinhibition and Conscientiousness with r = -0.41
v. Psychoticism correlated across all five factors as follows: Openness r = 0.26, Conscientiousness r = -0.41, Extraversion r = -0.33, Agreeableness r = -0.43 and Neuroticism r = 0.35

Suzuki, Samuel, Pahlen and Krueger (2015) correlated DSM-5 scales with the IPIP–NEO model and found similar results. Conscientiousness, Extraversion, Agreeableness and Neuroticism all had the highest correlations with the expected PID trait. They concluded that the Big Five "provides an overarching framework that can be fruitfully applied to personality pathology" (p. 352) and in part this thesis is responding to the request for more research in this area to better understand adaptive and maladaptive forms of the Big Five.

Further research from Widiger, Lynam, Miller and Oltmanns (2012) also sought to measure Big Five traits in maladaptive forms, including those based on obsessive–compulsive, borderline, narcissistic, avoidant and dependent personality disorders. They have previously undertaken a similar piece for research based on measuring psychopathic tendencies.

Gore and Widiger (2013, p. 816) correlated the NEO PI-R with the "5 Dimensional Personality Test" (van Kampen, 2012) and concluded "The results provided support for the hypothesis that all five domains of the DSM-5 dimensional trait model are

maladaptive variants of general personality structure, including the domain of psychoticism".

The PID model is evaluatively unbalanced, as for four of the five PID dimensions, one end is strongly adaptive and the other strongly maladaptive. Challenging this structure, Pettersson, Mendle, Turkheimer, Horn, Ford, Simms and Clark (2014, p. 433) present a persuasive case that "nonevaluative factors, which display maladaptive behavior at both ends of continua, may better approximate ways in which individuals actually behave". They have successfully applied Peabody's (1967) method for reducing evaluative bias by cracking one item out into quadruplets of items for the Multisource Assessment of Personality Pathology (MAPP) instrument (Pettersson et al., 2014). This was achieved through creating two items measuring the low end of each trait, one adaptively and one maladaptively, and creating two further items measuring the high end of each trait, again one adaptively and one maladaptively.

This research seeks to undertake a similar analysis of the Big Five. In particular, this thesis looks at dysfunctional behaviours at both ends of the Big Five polarities, whereas four of the five dimensions measured in the PID are assumed to only be maladaptive at one end.

In this research, the focus is on the impact of maladaptive personality traits on performance at work. In comparison to the PID model, the maladaptive behaviours researched in this thesis are less extreme and more common. Consequently, the PID model is not the focus of this thesis and support for this perspective is found in Suzuki et al. (2015, p. 343) who found that "the PID-5 scales generally have higher thresholds and provide more information at the upper levels, whereas the IPIP–NEO generally had an advantage at the lower levels." (p. 343). Nevertheless, the above research indicates that the Big Five can likely be conceptualised in both an adaptive and maladaptive form, at both ends of the polarity, and consequently this is the approach adopted in this thesis.

2.10 Gender Differences in the Big Five

Many researchers have examined the Big Five to explore potential individual differences by gender. Weisberg, DeYoung and Hirsh (2011) found little difference

between the genders at the level of the Big Five dimensions. However, when the Big Five factors are broken down, men and women did diverge, with women found to have statistically higher levels of Extraversion, Agreeableness, and Neuroticism. This lends support to the fidelity side of the bandwidth fidelity debate as “For some Big Five domains, the aspect level traits showed gender differences in opposite directions, which helps to explain why gender differences are not typically evident for the Big Five domains of Conscientiousness and Openness/Intellect, and why the gender difference for Extraversion is typically very small.” (Weisberg et al., 2011, p. 10).

An interesting study by Schmitt, Realo, Voracek and Allik (2008) examined the scale of differences in gender differences, across cultures. Counter intuitively, they found that in less economically developed countries, males and females exhibited a smaller degree of difference, exhibiting more similar personalities. However, in more economically developed countries, the difference between the genders became greater. They hypothesised that this is due to more prosperous societies enabling females and males to express more of their innate preferences, whereas less developed cultures may provide fewer opportunities to express one’s preferences. These changes appear to result from men’s cross-cultural personality variation, as in societies with less developed economies and more prescribed behavioural codes “a man is, indeed, more like a woman, at least in terms of self-reported personality traits.” (Schmitt et al., 2008, p. 178). This finding seems to be consistent with the research by Guadagno, Okdie and Eno (2007) who found greater criterion validities when an individual has more scope to express their individuality in the job role, and is not constrained by it. It is also plausible this could be explained to some extent by “trait activation theory” as described by Judge and Zapata (2015).

Nevertheless, on closer inspection, although statistically significant, these gender differences are often small in magnitude and Weisberg, DeYoung and Hirsh (2011, p. 10) found “… the distributions of traits for men and women are largely overlapping … One can see that both men and women can be found across a similar range of Agreeableness scores, such that, despite the fact that women score higher than men on average, there are many men who are more agreeable than many women, and many women who are less agreeable than many men. Given that Agreeableness showed the largest gender difference in our study, all other traits for

which we reported significant gender differences would show even greater overlap in men's and women's distributions."

2.11 Personality, Competencies and Job Performance

2.11.1 Correlations Between Personality and Job Performance

Understanding the relationship between personality and job performance is crucial if personality assessments are to be used effectively in a work setting. So, what is currently known about the personality-performance relationship so far?

The relationship between job performance and personality has been a frequent topic of research in the 20th century (Barrick, Mount & Judge, 2001; Johnson, 2004). Davis-Blake and Pfeffer (1989) provocatively suggested the link between dispositional traits and performance may be a mirage. However, Barrick and Mount (1991) undertook a meta-analysis and revealed correlations with performance for all the Big Five Factors, with the highest being for Conscientiousness with r = 0.22.

Salgado (1998) found the criterion validity between job performance and personality was equally significant in both civilian and military occupations. Judge, Higgins, Thorsen and Barrick (1999) have shown that Contentiousness positively impacts career success across life span whilst Neuroticism negatively impacts it. Salgado (2003) carried out a meta-analysis on Big Five and non-Big Five personality measures and prediction of job performance. His findings argued for the use of the Big Five rather than non-Big Five metrics to support selection decisions. Further correlations between the Big Five and academic performance were found by Poropat (2009).

The Big Five has also been shown to correlate with performance motivation with a multiple correlation of 0.49 with motivational criteria (Judge & Ilies, 2002). The Big Five model has also been used to correlate with job satisfaction having a multiple correlation of 0.41 (Judge, Heller & Mount, 2000). For example, high levels of Neuroticism were found to negatively impact on an individual's job satisfaction.

By 2001, after analysing a decade of research on the relationship between Big Five Personality traits and work performance, Barrick et al. (2001) found that the effect sizes remained the same and confirmed the validity generalisation only for

Conscientiousness in predicting overall work performance. Both these meta-analyses organised personality variables within the Big Five Model of personality.

Although there were statistically significant findings, their magnitude was judged to be low by Barrick et al. (2001). One of the criticisms of some of the studies in the meta-analysis was that they took a general criteria of job performance to correlate against rather than taking more specific measurement criteria that would take specific job / situational demands placed on the individuals by their working environment into account.

Meta-analysis carried out by Tett, Jackson and Rothstein (1991) indicated that, by confining their studies only to those in which researchers have formulated hypotheses about predictor-performance relationships or used a job analysis to choose personality predictors, the validity coefficients of the Big Five Factors were enhanced.

Further investigations at a finer level of detail by Hogan and Holland (2003) found "As performance assessment moved from general to specific job criteria, all Big Five personality dimensions more precisely predicted relevant criterion variables, which estimated true validates of 0.43 (Emotional Stability), 0.35 (Extraversion-Ambition), 0.34 (Agreeableness), 0.36 (Conscientiousness) and 0.34 (Intellect-Openness to Experience)" (p. 100).

The above research led to the conclusion that improving the alignment between personality and criterion performance could potentially improve understanding of the relationship between the predictors and work criteria and hence improve prediction.

2.11.2 Personality Outside of Work

As mentioned above, criterion validity as measured between Big Five and performance at work can be argued to be on the low side when correlations are between 0.2 and 0.3. At work, individuals may have situational demands placed upon them that inhibit them from acting on their personality preferences. If this was the case, it may be expected there will be higher validities reported outside of work, when we are typically freer to act upon our personality preferences. For example,

Guadagno, Okdie and Eno (2008) found high correlations between blog writing activity and Neuroticism of 0.39 and with Openness of 0.75.

2.11.3 Competencies

The first use of the term competency is often attributed to David McClelland (Sliter, 2015) following his paper "Testing for Competence Rather Than for 'Intelligence'" (McClelland, 1973). He argued for going beyond aptitude tests and finding non-ability drivers of performance.

The use of competencies has been increasing since the early 1980s and a seminal text was the book "*The Competent Manager*" by Boyatzis (1982). Prior to the use of competencies, HR typically focussed on the tasks, roles and responsibilities required to undertake a job. Boyatzis defined a job competency as "an underlying characteristic of a person which results in an effective and/or superior performance of a job ... it may be a trait, motive, skill, aspect of one's self-image or social role, or body of knowledge that he or she uses" (Boyatzis, 1982, p. 21).

Another definition referred to competencies as "combinations of knowledge, skills, abilities, and other individual differences (KSAOs) that are necessary for performance in a given job or job family" (Campion, Fink, Ruggeberg, Carr, Phillips & Odman, 2011).

More recent definitions have placed more focus on the role of behaviours in competencies. Some definitions of competence in fact focus on the behaviours required to perform a job or range of jobs, as illustrated by the following definition of a competency: "sets of behaviours that are instrumental in the delivery of desired results or outcomes" (Robertson, Callinan & Bartram, 2003, p 7). One reason for defining competencies in behavioural terms, is to enable organisations to communicate with their staff and inform them of the behaviours desired i.e. to let staff know which behaviours will be encouraged and developed, as well as which will be rewarded.

One benefit of a broad behavioural definition, is that it has greater applicability across ranges of jobs and/or an entire organisation. "The main advantage of the competency modelling approach has been its success in building the models that

lay the foundations for organization-wide integrated human resources applications" (Kurz & Bartram, 2002).

Further work has contrasted a competency with a Competency Potential. A Competency Potential has been defined as "a person(s) potential, or capability, to behave competently in the workplace" (Robertson et al., 2003, p 8). Big Five personality traits are an important part of this Competency Potential, as are an individual's values, motives and interests, and also their education and the skills they have developed.

A key determinant of which Competency Potentials become actualised in the workplace, is the context and environment. The interaction of an individual's personal attributes with the context / environment may either suppress a potential competency or nurture it to become a behaviour in reality.

From this perspective, Behavioural Competencies are best defined in terms of activity, whereas Competency Potential should be defined in terms of personal attributes. For example, the Great Eight competency of "Supporting and Cooperating" is expressed as an activity and therefore can be measured by an observer using a 360-degree instrument, whereas one way of measuring an individual's potential to exhibit this behaviour, would be their own self-assessment of their Big Five "Agreeableness" trait (Kurz & Bartram, 2002).

If competencies are defined very broadly, it is likely they will be underpinned by a variety of personality traits that are drawn from different factors across the Big Five. For example, the competency "Driving Organisational Change" may be linked to Extraversion as well as Conscientiousness. More narrowly defined competencies may link to one personality factor, or just one facet within a personality factor.

2.11.4 Behavioural Competencies Impact on Job Performance

Measures of competency are not the same as measures of performance. Many performance rating systems in organisations reduce an individual's performance over 12 months to a simple measure that can be used as a basis for anything from a significant pay rise to the initiation of remedial measures that may result in the individual being dismissed.

Kurz and Bartram (2002) suggest that “The performance is the choreographed stream of behaviours that will be judged overall as either ‘good’ or ‘bad’, ‘effective’ or ‘ineffective’, ‘successful’ or ‘unsuccessful’”.

The research literature indicates that there are many useful taxonomies of performance at work, which include that of Campbell, McCloy, Oppler and Sager (1993), Robertson and Kinder (1993), Hough (1992), Viswesvaran (1993), and Kurz and Bartram (2002). For example, Viswesvaran (1993) identified ten job performance dimensions to represent the entire job performance domain comprehensively. These included overall performance, job performance or productivity, quality, leadership, communication competence, administrative competence, effort, interpersonal competence, job knowledge and compliance with or acceptance of authority.

2.11.5 The Emergence of the Great Eight

Robertson and Kinder (1993) undertook a study that tested *a priori* hypotheses for personality facets (30 OPQ scales) as predictors of competencies. Diverse criteria across a set of 20 validation studies were grouped into twelve competencies, all of which had significant correlations with lower level personality scales. The study led to the development of the Inventory of Management Competencies (IMC) that provided a standardised criterion measure of 16 competencies using normative and ipsative response formats. The predictor and criterion variables covered much of the scope of what was later termed the Great Eight competencies (p. 239).

Nyfield, Gibbons, Baron and Robertson (1995) found the correlation between an overall measure of job performance and sixteen IMC behavioural competencies ranged between 0.21 and 0.55 (N = 1,043). Robertson, Baron, Gibbons, MacIver and Nyfield (2000) found similar results in a sample of 437 managers. They found that sixteen IMC measures of work performance (Commercial, Expert, Analytical, Innovative, Strategic, Organized, Decisive, Articulate, Literate, Supportive, Persuasive, Coordinating, Quality Driven, Flexible, Resilient and Motivated) all correlated positively with overall performance at work with a mean of 0.38 and the lowest being 0.04 and the highest 0.63 (p. 177). They concluded “… the results are particularly important in providing a counterpoint to the current high level of enthusiasm for a reductionist view of personality in which a small number of

personality constructs, such as Conscientiousness, determine overall work performance. The results from this study offer support for a more multi-faceted view of both performance and personality." (p. 179). One possible weakness of their study, which failed to find a positive correlation between Conscientiousness and overall performance, was their definition of Conscientiousness, which omitted the OPQ (Occupational Personality Questionnaire) "Achieving" scale and was purely based on "Dependability" oriented scales such as "forward planning", "conscientious" and "detail". These scales do tap into the "achievement" aspect of Conscientiousness, which has been identified in the NEO as an important facet of the Conscientiousness factor. In later research, the divergent validity pattern necessitated the separation of Conscientiousness into separate factors in the Great Eight.

Schmidt and Hunter (1998) examined the incremental validity that a measure of Conscientiousness adds over and above a General Mental Ability (GMA) measure in personnel selection. They found a worthwhile average increase in validity of 18%. In addition to Conscientiousness, their research also measured how the GMA combined with seventeen other measures used in personnel selection. Their table of validity coefficients by method (p. 265) has since been referred to as the "validity ladder" and others, such as Robertson and Smith (2001, p. 443), have visually displayed validity coefficients on a ladder. They found graphology at the bottom of the validity ladder, with a correlation with job performance of 0.02. Conscientiousness was in the middle of the ladder with a coefficient of 0.31 and broader personality tests scored 0.40. They found a combination of cognitive ability tests and integrity tests were at the top of the ladder with a coefficient of 0.65.

Through seven separate studies, Kurz (1999) created expert equations to predict the same sixteen IMC behavioural competencies Robertson et al. (2000) had used, based on thirty personality measures combined with verbal and numerical ability scales. The average correlation based on self-assessed competencies was 0.50 and 0.30 for boss assessed 360-degree competencies. With a sample size of 384 across four studies, Gotoh (1999) followed a similar procedure based on just boss 360-degree feedback in two Asian studies and found correlations of 0.25 based on predicting the same sixteen competencies. Briceno (2002) also validated the Great

Eight model and found 75% of the *a priori* predictions were supported, although the sample size was only 62.

Judge et al. (2002) found a strong correlation of 0.36 between Conscientiousness and Leadership in a graduate sample. However, this correlation fell to 0.17 in a sample of public service roles, and down to 0.05 in a private sector sample. This suggests the importance of context in understanding the relationship between personality and performance.

By comparing the taxonomies of performance as proposed by the above researchers, and through an expert analysis of their various correlation matrices, Kurz and Bartram (2002) hypothesized that an eight-factor model could account for a significant amount of the predictor criterion variance. They created five competency domains clearly linked to the Big Five deductively and empirically, yet also added three additional competencies, bringing the total to eight. Based on the findings of Hough (1992) and Hough et al. (1998) they added two competencies originally named “Achievement” and “Potency”. They then added a third ability related component named “Analysing and Interpreting” combining measures of personality and verbal / numerical abilities to define the predictor, and measures of workplace behavioural competencies to define the criterion.

Bartram, Kurz and Baron (2003) collated thirty-three validation studies to explore the Great Eight structure. Based on line manager and supervisor feedback scores against the Great Eight, they found *a priori* hypotheses for all eight competencies were supported. The correlations varied between 0.23 and 0.44 across the eight predictor-competency pairings.

Kurz (2003) named the Great Eight names and divided them into four clusters as follows:

i. Solving Problems, made up of Analysing Situations and Creating Concepts
ii. Influencing People, made up of Relating to People and Controlling Resources
iii. Giving Support, made up of Respecting People and Adapting to Demands
iv. Achieving Objectives, made up of Delivering Results and Driving Performance

Bartram et al. (2003) hypothesized that the eight competencies could be divided into two sets of four. They termed one set of four “Transactional” with a focus on management, and the other “Transformational” with a focus on leadership. They named the four clusters as follows:

i. Developing the Vision, made up of Analysing & Interpreting (transactional) and Creating & Conceptualising (transformational).
ii. Sharing the Goals, made up of Interacting & Presenting (transactional) and Leading & Deciding (transformational).
iii. Gaining Support, made up of Supporting & Co-operating (transactional) and Adapting & Coping (transformational).
iv. Delivering Success, made up of Organizing & Executing (transactional) and Enterprising & Performing (transformational).

Following on from this Kurz (2003) proposed more accessible Great Eight names and divided them into four clusters (two of which now feature in the well-known Saville Consulting Wave model) that turn the leadership model into a general model of performance as follows:

i. Solving Problems, made up of Analysing Situations and Creating Concepts
ii. Influencing People, made up of Relating to People and Controlling Resources
iii. Giving Support, made up of Respecting People and Adapting to Demands
iv. Achieving Objectives, made up of Delivering Results and Driving Performance

However, after further research, Kurz (2005) proposed an alternative model and dropped the transactional / transformational distinction. Kurz (2005) found better empirical support for the eight competencies to be divided into the same four clusters with each of the four placed in a two by two matrix as follows: On one axis was a divide between the Alpha and Beta higher order personality domains (Digman, 1997) and on the other a “task” versus “people” distinction.

i. Developing the Vision was placed in the intersection of beta and task
ii. Delivering Success was placed in the intersection of alpha and task

iii. Sharing the Goals was placed in the intersection of beta and people

iv. Gaining Support was placed in the intersection of alpha and people

Kurz, Bartram and Baron (2004) found further evidence to support the Great Eight hypothesis thorough a Principal Components Analysis with Varimax Rotation performed on four UK samples based on a total of 365 professionals. The predictor and criterion measures that were factor analysed were as follows:

i. the 30 OPQ Concept Model 4.2

ii. Verbal (VMG2) and Numerical Reasoning (NMG2) tests

iii. the sixteen Behavioural Competencies from the Inventory of Management Competencies (IMC) measured with 10 items for each competence

iv. a measure of overall performance based on 360 boss feedback assessing “proficiency” and “promotability” using six items for each

There were eight factors with eigenvalues greater than one and they accounted for 68% of the variance. Five of the factors were identified as the Big Five and were labelled in behavioural competency terms as follows:

i. Openness underpinned “Creating & Conceptualising”

ii. Conscientiousness underpinned “Organizing & Executing”

iii. Extraversion underpinned “Interacting & Presenting”

iv. Agreeableness underpinned “Supporting & Cooperating”

v. Neuroticism, reversed to Emotional Stability, underpinned “Adapting & Coping”

The additional three factors were labelled as follows:

i. “General Mental Ability” measured through verbal aptitude and numerical aptitude underpinned “Analysing and Interpreting”

ii. “Potency” was renamed “Need for Control” and measured through Extraversion. It underpinned “Leading and Directing”

iii. “Achievement” was renamed “Need for Achievement” and measured through low Agreeableness and high Conscientiousness. It underpinned “Enterprising and Performing”

In this research, the Great Eight inter-correlations were all below 0.33 and so the factors were considered fairly independent.

i. Leading & Deciding and Enterprising & Performing correlated the highest at 0.33 and this was considered to be due to both being underpinned by different aspects of Extraversion.

ii. Supporting & Co-operating (underpinned by Agreeableness) correlated negatively with Enterprising & Performing (underpinned by low Agreeableness) at -0.32

iii. Creating & Conceptualising, Interacting & Presenting, Leading & Deciding and Enterprising & Performing were all correlated between 0.24 and 0.33. It was hypothesized these four competencies may collectively be the equivalent to Digman’s personality based Beta Factor, as they are underpinned by Openness, Extraversion and Low Agreeableness.

iv. Analysing & Interpreting correlated 0.26 with Creating & Conceptualising and 0.20 with Organising & Executing. It also correlated -0.22 with Leading & Deciding and -0.29 Supporting & Co-operating.

The eight factors in this model originally proposed by Kurz and Bartram (2002) and Kurz et al. (2004), was later labelled the “Great Eight Competencies” by Bartram (2005). Bartram (2005) made the case for Agreeableness and Emotional Stability Competency Potentials to be combined into one personality cluster for predictive purposes. The Great Eight was then considered to encompass the majority of the above performance constructs into one comprehensive workplace taxonomy.

Saville, Maclver and Kurz (2009) developed the Great Eight model further and termed the combined Agreeableness and Emotional Stability measure “Adaptability” on the personality predictor side, and “Adapting Approaches” on the competency criterion side.

Saville et al. (2009) then placed the eight competencies in a hierarchical model with two competencies in each of four clusters. These were named “Delivering Results”, “Solving Problems”, “Influencing People” and “Adapting Approaches”.

In this way, the Saville et al. (2009) four-tier hierarchical model covered not just the Great Eight competencies, but also the Big Five personality constructs as they:

i. Separated “Need for Achievement” and “Dependability” themes within Conscientiousness, with the quadrant being termed “Delivering Results”

ii. Separated “Creativity” and “Analysis” themes within Openness, with the quadrant being termed “Solving Problems”

iii. Separated “Need for Power” and “Sociability” themes within Extraversion, with the quadrant being termed “Influencing People”

iv. Based on the contextual performance factor of Bartram (2005), combined the “Supporting & Cooperating” theme within Agreeableness, with the “Adapting & Coping” theme within Emotional Stability, labelling this quadrant “Adapting Approaches “

A diagram showing a summary of the relationship between the General Factor of Personality, Digman’s (1997) and DeYoung’s et al. (2007) two higher order factors, the Big Five and the Great Eight model is shown in Figure 2-4.

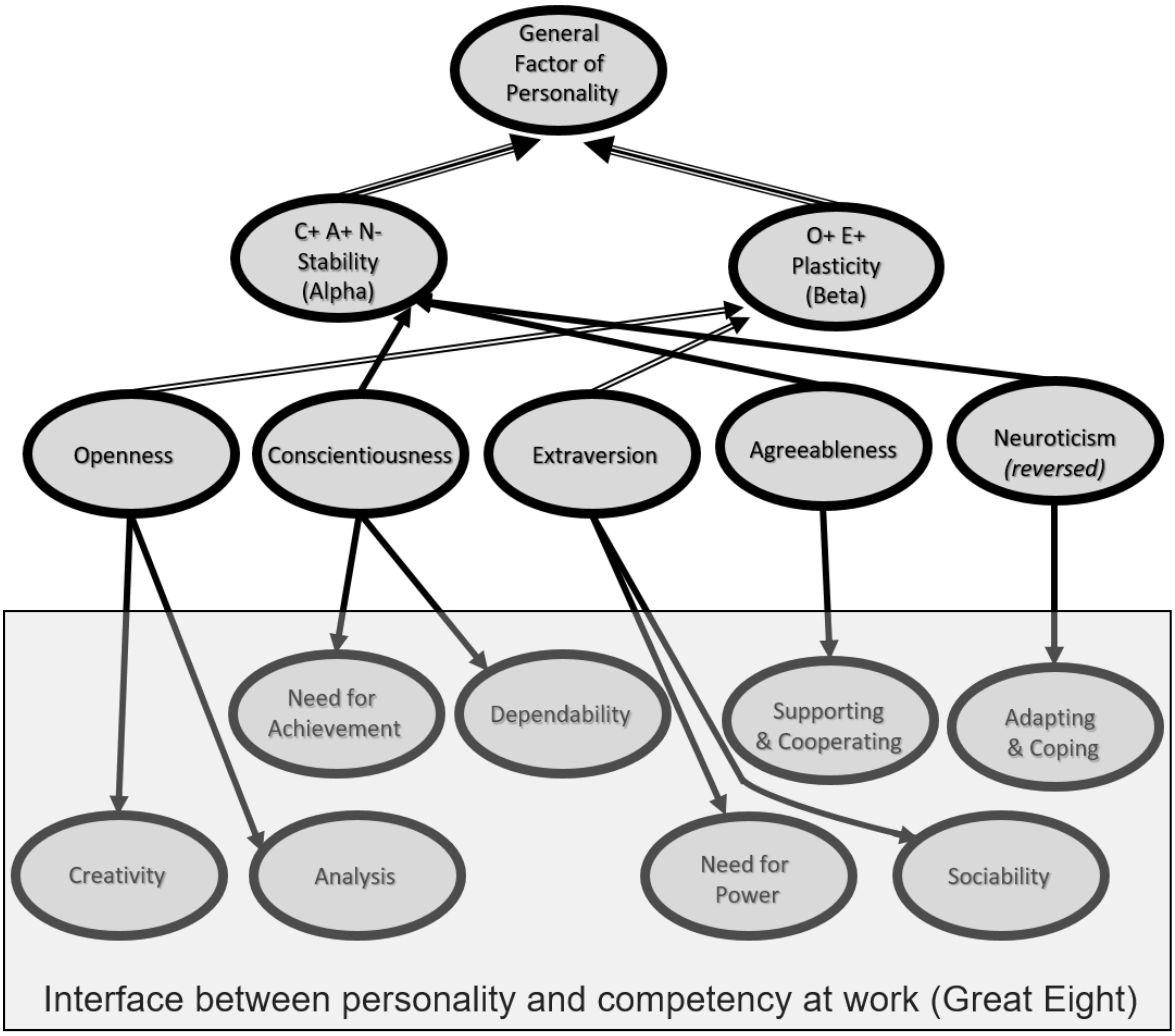

Figure 2-4: GFP, two higher order factors, the Big Five and the Great Eight

Saville et al. (2009, p. 564) created the thirty-six personality facet instrument named "Wave" based on a criterion-centric approach. The Wave personality model was designed to predict narrow as well as the broad Great Eight (Bartram, 2005) competencies. A sample of 308 professionals completed Wave and a Principal Components Factor Analysis with Varimax rotation undertaken. An eight-factor specified solution explained 60.1% of the variance. However, Saville et al. (2009) did not detail the eigenvalues or give details of a parallel analysis. So, it is not possible to reach a judgement on the true number of factors in the dataset. Nevertheless, the resulting rotated component matrix maps the thirty-six personality measures onto the eight factors in a way consistent with the Great Eight (Bartram, 2005).

In addition to Saville et al. (2009) creating the Wave personality measures, they also created Great Eight competency measures suitable for 360-degree observer data collection. Both the personality and competency measures use unipolar scales. Both instruments only contain positive items as “items that employ negation by using words such as “not” typically have lower reliability and are prone to respondent response error due to misreading. Negative items can help in controlling acquiescence responding, but this can result in lower reliability.” (Saville et al, 2009, p. 539).

Furthermore, no items were reversed and “Items were designed to be unipolar with higher scores indicating more effective performance.” (Saville et al., 2009, p. 539).

With the Saville Wave instrument “Care was also taken to avoid focusing on concepts that were likely to have negative correlations with overall job performance and potential ratings.” (Saville et al., 2009, p. 539).

Although the Saville Wave design seeks to maximise criterion validity, Saville et al. (2009) have overlooked the evaluative bias component in their personality measures.

In the light of the voluminous research on the Great Eight Competencies (Bartram, 2005) it was decided to adopt this model in order to assess the criterion-related validity of the proposed personality measure in this research.

2.12 Conclusion

A wide range of personality theories, often supported by a psychometric to operationalise them, have been created and evolved over the last century. Early organisational applications of the measures were often more reductionist in nature and focussed on helping make better selection decisions. However, in the last three decades there has been an increased interest in applications to help individuals develop, adopting an approach more aligned with humanistic psychology.

In the 1960s, many psychologists considered personality assessments unable to predict behaviour consistently enough to be useful in work settings. However, the emergence of the Big Five as a comprehensive taxonomy has enabled modern day researchers to show there is more than enough consistency in behavioural

predictions for a personality measure to now be used organisationally. Research on personality has come a long way and was galvanised in the 1990s when it was given a new lease of life through the emergence of the Big Five.

Undoubtedly, the evidence points to the biological basis of personality, yet evidence also shows personality is significantly impacted by the environment. Theories such as “trait activation” are more contemporary in blending the biological and environmental perspectives and this is aligned with the approach in this thesis whereby a more holistic and balanced approach is taken to modelling the Big Five.

The large number of variations and alternatives to the Big Five also highlight varying degrees of evaluative bias and there is a marked difference in how much social desirability different instruments embody. This supports one of this thesis’ aims, which is to explore how to mitigate evaluative bias. This approach gives a weighting to the utility of user validity (MacIver et al., 2014) which could be improved if evaluative bias could be reduced. For example, if a measure is less subject to evaluative bias, the test user will have greater confidence the construct has been measured in a comprehensive and balanced way. This in turn helps the test user make a more effective interpretation of the test output.

The literature shows the bandwidth fidelity debate is still ongoing and this research intends to provide some more evidence in favour of the fidelity side of the argument, as many researchers have called for a more detailed exploration of the space beneath the Big Five dimensions. The literature on the ‘dark side’ is compelling, and there can be no doubt that there are personality traits that can negatively impact performance in one context, yet support performance in another context. The literature does tend to invoke models of mental disorder in order to build ‘dark side’ trait models, yet there is a shortage of literature exploring the idea that “too much of a good thing” can negatively impact performance without the need to pathologize. This thesis intends to fill this research gap in the literature.

Finally, much literature demonstrates the utility of measuring behavioural competencies at work as suitable criterion measures. The Great Eight model is one of the most well researched models of behavioural competence and is supported by twenty-seven years of field studies demonstrating its potency. It has therefore been adopted as a useful framework for this research.

3 METHODOLOGY

3.1 Introduction

This chapter details the research methods used in the studies and a rationale for the statistical techniques. Most of the studies involved assessments conducted via one or more online questionnaires. The samples are described and the studies outlined, including the instruments used and an overview of how the analysis was undertaken.

The validation strategies adopted in this research guided the formulation of the hypotheses to be tested and are shown in Table 3-1. More detail can be found in section 3.4. Please refer to Studies 1, 2, 3, 4, 5 and 6 for full details of the hypothesis and the results. The research questions posed in this thesis have already been detailed in section 1.10 entitled “Research Aims and Research Questions”.

Table 3-1: Validation Strategies used in each study

Study	Validation Strategy
Study 1	Construct validity
Study 2	Convergent and divergent validity
Study 3	Criterion validity
Study 4	Construct validity and test re-test reliability
Study 5	Construct validity
Study 6	Convergent and divergent validity

3.2 Participants and Design

The research design used in the present study is a cross-sectional design, through a series of field samples that were convenient. Volunteers were targeted who were highly likely to be employed in both small and large organisations. The volunteers’ motivation to take part included:

i. An altruistic desire to help the research
ii. An interest in finding out more about their own personality and/or performance at work
iii. An interest in seeing the results and conclusions of the research

As this research was not based on a random sample, or a stratified sample, care needs to be taken not to overgeneralise the findings or to imply that they apply to the entire working population.

In gathering the performance at work data, participants were sought who worked in a professional environment as sole contributors, as well as managers and leaders who had staff working for them. Requests to participate came from either a HR department enrolled by the author, who typically placed the offer on an internal notice board or through a direct email link sent with an invitation to participate. There was an element of snowball sampling, as some participants suggested to others that they may wish to take part in the research. This was supported by the use of email and social media making it easier for participants to share the research request with many of their colleagues who may be interested to help at the same time.

The data was gathered from English speaking countries as well as multi-nationals and national organisations with English speaking staff in the UK, US, Canada, Mexico, Australia, South Africa, Germany, France and Belgium. Noticeboards, postings on social media and word-of-mouth were found to be very effective. Participants were sought who were willing to complete a series of questionnaires to assess their personality without being remunerated for it. Sources were targeted to maximise the likelihood of attracting professional staff some of whom would be in managerial or leadership positions. Undergraduate students who were less likely to have professional work experience were avoided. Over all questionnaires used in this dissertation, where data on their professional work status was provided by the volunteer, it was found 86.1% were classified as in full time or part time work. Only 4.7% were classified as students. In terms of the level of operation, 6.3% were CEO level and another 3.1% President level. 16.5% were classified as Board/Executive Level/Director/Vice President, 17.8% were managers and 18.8% were experienced professionals. At a more junior level, 3.5% were Supervisor/Team Leader and 2.8% entry-level professionals. Business owners and entrepreneurs accounted for 13.5% of the data. A combination of administrative staff, front line/support staff or blue-collar workers accounted for 5.4%. Finally, the not applicable and prefer not to say category accounted for 8.1%. This demographic was considered highly suitable for researching using the Great Eight behavioural competency observer feedback

assessment and those that completed the initial personality questionnaires were then offered the opportunity to gather such data on their performance at work.

Study one involved two personality questionnaires and 2,506 people successfully completed them. The same 2,506 people were then invited to complete further questionnaires for studies 2, 3, 4, 5 and 6. In study 4 new participants were also invited to take part in order to validate the model built on a new sample.

3.2.1 Ethics

The University of Westminster Ethics Committee approved this research endeavour and it is also compliant with the British Psychological Society's ethical guidelines. Since some of the participants were sourced from North America, it was also assured that the research met the requirements of the American Psychological Association ethics guidelines.

Everybody that took part was required to give their consent having read an introduction to the questionnaire and research. Participants were also told they could withdraw from the research at any point without needing to give a reason or discuss it.

Where possible, participants were offered a short, personalised report based on the answers they provided as an incentive to participate, as specified in Table 3-2. Whether a report was provided or not, they were also offered the opportunity to attend a webinar where they could ask any questions about the research or their own personal results. Furthermore, if participants needed to talk about their results confidentially, they were offered the opportunity to do so.

3.3 Instruments

Table 3-2: Instruments and samples used in this dissertation

Name	Questionnaire Source	Number of Items	Sample Size	Studies used in	Report provided to participant
Development of BF57	This dissertation	410	2,506	Study 1	Yes
HDS - Hogan Development Survey ("Dark Side")	Hogan and Hogan, 1997	168	138	Study 2	Yes
HPI – Hogan Personality Inventory ("Bright Side")	Hogan and Hogan, 1995	206	154	Study 2	Yes
Trait Descriptive Adjectives	Goldberg, 1992	100	420	Study 2	No
IPIP-NEO	Johnson, 2014	120	234	Study 2	No
Great Eight Competencies	Kurz and Bartram, 2002	8	254	Study 3	Yes
Professional Competencies	Lumina Learning, 2014	71	254	Study 3	Yes
Leader Competencies	Lumina Learning, 2010	96	73	Study 3	Yes
BF57 Self	This dissertation	57	438	Study 4	No
BF57 360	This dissertation	57	117	Study 5	No
Social Desirability of BF57	This dissertation	57	26	Study 6	No
Social Desirability of IPIP-NEO	This dissertation	120	28	Study 6	No
Social Desirability of TDA	This dissertation	100	40	Study 6	No

3.4 Procedure

3.4.1 Study One: Creating the BF57 Questionnaire

The first study involved the creation of an item pool to measure eighteen Big Five-based personality variables and included exploration of the factor structure of the data using exploratory factor analysis (Cattell, 2012; Bernstein & Teng, 1989; Comrey, 1978) and parallel analysis (Horn, 1965; Glorfled, 1995).

All the items generated were designed to have face validity in terms of measuring the Big Five at both ends, adaptively and maladaptively. The item pool created was then assessed by a panel of seven experts for item quality. All experts had a background in business psychology and psychometrics. Each expert assigned every item to a Big Five polarity, both adaptively and maladaptively. Items on which the experts failed to unanimously agree on quality or assignment, were eliminated.

A procedure for scale and item-development was adopted that included the use of the Cronbach's Alpha statistic (Cronbach, 1951), item-to-scale total correlations and exploratory factor analysis. Expert judgment was also used to ensure the scales were broadly measured in order to mitigate the risk of any scale becoming a bloated specific. The best performing items were selected from the item pool to ensure that a broad and reliable measure of the eighteen variables was achieved. The same items selected to measure the eighteen scales were also used to create five scales that map onto the Big Five, so that later studies could compare the reliability and validity of the five measures with the more detailed eighteen scales to help explore the bandwidth fidelity argument. The rationale for the use of the eighteen scales will be explained later in section 4.

In study one, confirmatory factor analysis was also used to further understand the structure of the model and test for the presence of the Big Five.

The questionnaire created is a fifty-seven item sub set of the item pool and is referred to in this thesis as the BF57.

3.4.2 Study Two: The Convergent and Divergent Validity of the BF57

The second study involved exploring the concurrent validity of the new BF57 questionnaire through identifying and testing hypothesised relationships with other instruments. This included the IPIP-NEO (Johnson, 2014), the HPI “Bright Side” (Hogan & Hogan, 1995), the HDS “Dark Side” (Hogan & Hogan, 1997; Hogan & Hogan, 2001) and Goldberg’s (1992) one hundred “Trait Descriptive Adjectives” (TDA). These instruments are all either alternative measures of the Big Five or, in the case of the HDS, a particularly interesting measure of maladaptive behaviour, with a well-researched relationship to the Big Five.

Correlational and Multitrait-Multimethod (MTMM; Campbell & Fiske, 1959) analyses have been undertaken to test for convergent and divergent validity.

This study also sought to place the new BF57 scales within the periodic table developed by Woods and Anderson (2016) who have explored the space between the pure five factors through the use of circumplex models that consider how any personality scale may have a primary as well as a secondary Big Five loading.

3.4.3 Study Three: The Criterion Validity of the BF57

The third study involved testing hypotheses related to criterion validity. This was achieved through gathering 360-degree feedback data on the performance at work of a subset of the participants in the research. The 360-degree instruments included a measure of the Great Eight competency model (N = 254), a 360-degree leadership model (N = 73) and a 360-degree professional competencies model for individual performers (N = 254).

The Great Eight competencies (Kurz & Bartram, 2002) were chosen for criterion validation due to the large amount of research data available on the model. A refined set of competency titles (Kurz, 2003) was used and supplemented with faceted definitions taken from proprietary Lumina Learning 360 tools. The items were measured using a five-point effectiveness scale and are detailed in Table 11-1 in Appendix I. The full Great Eight item test and rating scale can be deployed by researchers by referencing this dissertation.

Importantly, the criterion-related validity of the proposed personality measure has been explored by testing the *a priori* derived hypotheses on the relationship between the proposed personality dimensions and facets with the Great Eight Competencies (Kurz & Bartram, 2002; Kurz, 2003; Bartram, 2005) as the measure of performance using correlational analyses. Correlational analysis was also used to identity which scales accounted for more of the variance when correlating with a number of varying indicators of performance at work.

3.4.4 Study Four: Re-validating the BF57 with a Second Sample

The fourth study sourced a second sample to re-validate the five dimensions and the eighteen scales. A further exploration of the factor structure on the new data was undertaken with 438 participants, using exploratory factor analysis and parallel analysis. The Cronbach's Alpha (Cronbach, 1951) statistic was also re-evaluated, and a test-retest analysis undertaken based on those people in this sample who had also completed the questionnaire in study one. 195 of the 438 had done study one, and 243 were new participants.

Due to the reduced sample size of the second study, it was not possible to repeat the confirmatory factor analysis undertaken in study one.

3.4.5 Study Five: Validation of the BF57 with 360 Feedback

The fifth study requested observer feedback using the BF57 questionnaire, and correlated the self-perception of the eighteen scales with that of the feedback group.

3.4.6 Study Six: Evaluative Bias of the TDA, IPIP-NEO and BF57

The sixth study involved measuring the social desirability of the TDA, IPIP-NEO and BF57 and comparing the results. Participants scored the items not on how they saw themselves, but on how socially desirable they thought the items were. Forty people assessed the TDA, twenty-eight the IPIP-NEO and twenty-six the BF57.

3.5 Data Cleaning

All data was gathered through online questionnaires. Participants were not required to answer all the questions and any questionnaire that was not filled in completely

was discarded prior to the analysis, as was any data where consent had not been given by the participant.

3.6 Approach to Scale Development

When scales are constructed, the constructs need to be validated. The validation strategy and statistical analysis of this research was guided by classical test theory (Cronbach & Meehl, 1955). As advocated by Cronbach and Meehl (1955), this has involved validation of both the theory and the measure simultaneously. More recent researchers have suggested that construct validation needs to be an ongoing process involving replicating the study and refining the research, the construct and the measurement (Watson, 2012). Study four sought to replicate study one and validate the scales on a new sample.

Commenting on questionnaire construction, John and Soto (2007) suggest “The cycle continues, until a working model has been established that is ‘good enough’ - one that the investigator can live with, for now, given the constraints and limits of real life research. In other words, scale construction and construct validation go hand in hand, one cannot be separated from the other, and both fundamentally involve theory building and theory testing efforts.” (p. 489). This iterative approach typically involves at least two of the three approaches to scale construction, as outlined by Burisch (1986). Burisch (1986) goes on to suggest that a combination of all three is typically recommended. What follows is a summary of Burisch’s (1986) three different approaches for model building and item selection.

3.6.1 The Deductive Approach

This is also sometimes called the rational-intuitive approach and involves the creation of items on the basis of theory, and the test developer's understanding of the theoretical construct. Techniques include expert analysis and consensus on the quality of items. One potential risk in this approach is that the test developer and their supporting experts may not have a perfect understanding of the construct.

In this research, the deductive approach involved using the Big Five as the guiding theory in order to construct the items, through bifurcation of the Big Five scales into

measurement of both polarities, followed by further bifurcation to create adaptive and maladaptive items.

A good example of a personality model developed deductively is the Occupational Personality Questionnaire (Concept Model, OPQ CM4.2; SHL Group, 1993). The OPQ draws on the theory of the 16PF and defines four high level dimensions that are theoretically, rather than empirically based.

3.6.2 The Inductive Approach

This is also sometimes called the internal approach, and involves identifying the factor structure, and selecting items that have good factorial and discriminant validity. The inductive approach typically involves the use of the Cronbach's Alpha (Cronbach, 1951) statistic to ensure good internal consistency. It therefore places a higher weighting on reducing error variance in the final model. The inductive approach is essentially empirical by nature, and on its own does not enable the naming of the extracted factors. However, it is well suited to finding the model with the best fit from a range of possibilities. The inductive approach has also been used in this research through the use of factor analysis, item-to-scale correlations and analysis of Cronbach's Alpha (Cronbach, 1951) statistics.

A good example of a personality model developed inductively is the 16PF as the sixteen factors were primarily developed through factor analysis (Cattell, Eber & Delhees, 1968).

3.6.3 The Criterion-Centric Approach

This is also sometimes called the external approach or the criterion keying approach. Here, items are selected based on how strongly they correlate with external criteria. This has the advantage of building criterion validity into the model developed. On the other hand, this approach can result in items being selected that appear to have no relevant content or theoretical link to the construct being measured. For this research, items were generated with performance at work in mind, and as such the item generation process anticipated criterion validation. In this regard, this research is also criterion-centric.

A good example of a personality model developed with a criterion-centric approach is the Saville Wave model (Saville et al., 2009) as items with low criterion validity were removed from the item pool in its development, even if they may have been strong items deductively or inductively. This approach is likely to increase the criterion validity of the final model developed.

3.7 Statistical Techniques

3.7.1 Descriptive Statistics

These were used to document the geography and demographics of the samples.

3.7.2 Reliability - Cronbach's Alpha

Cortina (1993, p. 99) states the formula for Cronbach's Alpha (Cronbach, 1951) is:

$$N^2 \times M(COV) \div SUM (VAR/COV)$$

The terms are defined as follows:

i. N is the number of items in the scale

ii. M(COV) is the mean inter-item covariance

iii. SUM (VAR/ COV) is the sum of all elements in the variance/covariance matrix

It is also possible to compute Cronbach's Alpha (Cronbach, 1951) by replacing M(COV) above with the correlations among the items. Given that in the original item pool the BF57 items selected in this research did not have equal variances, this would be an invalid assumption to make. That is, in this thesis all Cronbach's Alphas (Cronbach, 1951) reported have been calculated in SPSS version 23 assuming the items are not standardized.

The constructs created in this thesis have had their Cronbach's Alpha values computed. Field (2009) recommends the Cronbach's Alpha value should exceed 0.7 and Murphy and Davidshofer (1988) suggests it should exceed 0.6. An overview of other researchers' recommended levels of Cronbach's Alpha can be found in Peterson (1994).

Schmitt (1996, p. 353) critiques the use of Cronbach's Alpha and concludes "There is no sacred level of acceptable or unacceptable level of alpha. In some cases, measures with (by conventional standards) low levels of alpha may still be quite useful". Given the BF57 scales are each based on three or four items, coefficients at the lower end of the spectrum (i.e. 0.6) were deemed acceptable for the scales and 0.7 for the higher level Big Five measures that contain between 4 and 13 items.

3.7.3 Correlational Analysis

The Pearson product-moment correlation was used to establish construct and criterion-related validity. In particular, it was used explore the relationship between the scales in study one, the relationship between different instruments in study two, the correlation between the BF57 and performance in study three, computing the test-retest statistics in study four and the relationship between self-report and observer-report scales in study five.

For measures of construct and criterion validity, raw scores are always reported in this thesis. In addition, where helpful these correlations have been reported a second time, corrected for measurement error in order to estimate the true magnitude of the correlation. This is explained below.

3.7.4 Using Cronbach's Alpha to Correct for Attenuation

When correlations between two variables are used to compute construct and criterion validity there will be random measured error in each variable. This will result in the true correlation between the variables being under reported by the raw correlation. To estimate the true correlation between the variables, assuming they were measured perfectly reliably, requires the following adjustment termed "correction for attenuation":

$$\rho_{x'y'} = \rho_{xy} \div \sqrt{\rho_{xx}\rho_{yy}}$$

The terms and key assumptions are defined as follows:

i. Random variables X and Y correlate with ρ_{xy}

ii. Cronbach's Alpha for variable X is ρ_{xx}

iii. Cronbach's Alpha for variable Y is ρ_{yy}

iv. X and Y are assumed to be imperfect (i.e. unreliable) measures of underlying variables X' and Y' and are assumed to have independent errors

v. $\rho_{x'y'}$ is a measure of the true correlation between variables X' and Y'

How well the variables X and Y are measured affects the correlation of X and Y. The correction for attenuation tells you what the correlation would be if you could measure X and Y with perfect reliability.

The above formulae was coded into Microsoft Excel by the author and the relevant correlations taken from SPSS version 23 analysis and then input to Microsoft Excel.

3.7.5 Steiger's Z – Test

In studies two and three Steiger's (1980) Z-transformations for dependent samples were undertaken to examine the differences between the magnitude of the observed correlations for adaptive and maladaptive versions of the BF57 scales, with other instruments' variables. The results have been displayed in the format (r_1 = a cf. r_2 = b, Z_h = c, p = d) where r_1 is the correlation of the other instrument's variable with the adaptive scale and r_2 is the correlation of the variable with the maladaptive scale. The correlation between the adaptive and maladaptive BF57 scales is also required to conduct Steiger's Z – Test, as these correlations constrain the level of deviation between the BF57 scales and the other instruments' variables. BF57 scale correlations are computed in study one and later used within the Steiger's Z – Test calculations. The software used to undertake this analysis can be found at:

http://www.psychmike.com/dependent_correlations.php

3.7.6 Principal Component Analysis (PCA)

Studies one, two and four involved undertaking factor analysis. SPSS (version 23) was used for the data modelling.

Contrasting factor analysis with the more straightforward correlational analysis in 1978 Cattell described the technique as "the furthest logical development and reigning queen of the correlational methods" and highlighted that it "is capable of

revealing patterns and structures responsible for the observed single relation connections." (Cattell, 2012, p. 4). Principal Component Analysis, supported by Parallel Analysis, has been used in this thesis to ascertain the numbers of factors in a number of datasets, based on the scales measured. Care has been taken not to infer the number of factors in a data set by undertaking PCA on item level data as Bernstein and Teng (1989) suggest this can be spurious evidence and that "Criteria for dimensionality applicable to continuous (scale-level) data are therefore inappropriate for discrete (item-level) data" (p. 467). Comrey (1978, p. 648) has advised against the use of PCA on item level data as it typically "produces too many factors, and distorts the rotational solution". This is in part due to the categorical nature of Likert based item level data invalidating key assumptions needed for the technique and that differing evaluative bias across items can produce unwarranted dimensions (Brenstein & Teng, 1989).

3.7.7 Parallel Analysis

Horn's (1965) Parallel Analysis was used to identify the number of factors in various datasets used in this thesis. Based on the scores for the scales, the eigenvalues extracted from the PCA were compared with those from a Monte Carlo simulation of 1,000 data sets so as to ensure the PCA analysis exceeds the 95th percentile of the Monte Carlo random data (Glorfled, 1995), using the following software:

https://analytics.gonzaga.edu/parallelengine/

3.7.8 Structural Equation Modelling (SEM)

Confirmatory factor analysis was undertaken and the presence of the Big Five model tested for. SEM has been used as it can provide further insight than conventional exploratory factor analysis or regressions.

EQS 6.3 (Bentler & Wu, 2017) was used assuming multivariate normality. In doing so, factor and error variances were constrained.

4 STUDY ONE: CREATING THE BF57 QUESTIONNAIRE

4.1 Introduction

4.1.1 Study One Objectives

The first objective was to develop a measure of personality that synergised recent advances in personality theory by combining an idea inspired by Jungian Typology with the Big Five personality model.

This thesis refers to the Big Five itself as having five "dimensions" as shown in Table 4-1 below.

Table 4-1: Five Dimensions – The Big Five

Dimension Number	Big Five Name
1	Openness
2	Conscientiousness
3	Extraversion
4	Agreeableness
5	Neuroticism

Study one measures both ends of the Big Five dimensions independently and this research refers to these ten polarities as the ten "aspects" as shown in Table 4-2. That is to say, the five dimensions are bifurcated into ten aspects.

The ten aspects are referred to by the industry standard names (for a fuller definition see section 2.2.2 The OCEAN Acronym for the Big Five) with the addition of the terms 'Positive Pole' and 'Negative Pole' to make clear the distinction between the five dimensions and the ten aspects.

For ease of reference, codes for these ten aspects were also created and are shown below in parentheses after the aspects' names in Table 4-2.

Table 4-2: Ten Aspects – The Big Five at Both Polarities

Aspect Number	Ten Aspect Name
1	Openness Positive Pole (O+)
2	Openness Negative Pole (O-)
3	Conscientiousness Positive Pole (C+)
4	Conscientiousness Negative Pole (C-)
5	Extraversion Positive Pole (E+)
6	Extraversion Negative Pole (E-)
7	Agreeableness Positive Pole (A+)
8	Agreeableness Negative Pole (A-)
9	Neuroticism Positive Pole (N+)
10	Neuroticism Negative Pole (N-)

Aspect numbers 1 to 8 above were further bifurcated through conceptualising each in turn both adaptively and maladaptively, creating scales 1 to 16 in Table 4-3 below.

Table 4-3: Eighteen Scales – The Big Five Adaptively and Maladaptively

Scale Number	Eighteen Scale Name
1	Openness Positive Pole (O+ Adaptive)
2	Openness Positive Pole (O+ Maladaptive)
3	Openness Negative Pole (O- Adaptive)
4	Openness Negative Pole (O- Maladaptive)
5	Conscientiousness Positive Pole (C+ Adaptive)
6	Conscientiousness Positive Pole (C+ Maladaptive)
7	Conscientiousness Negative Pole (C- Adaptive)
8	Conscientiousness Negative Pole (C- Maladaptive)
9	Extraversion Positive Pole (E+ Adaptive)
10	Extraversion Positive Pole (E+ Maladaptive)
11	Extraversion Negative Pole (E- Adaptive)
12	Extraversion Negative Pole (E- Maladaptive)
13	Agreeableness Positive Pole (A+ Adaptive)
14	Agreeableness Positive Pole (A+ Maladaptive)
15	Agreeableness Negative Pole (A- Adaptive)
16	Agreeableness Negative Pole (A- Maladaptive)
17	Neuroticism Positive Pole (N+ Maladaptive)
18	Neuroticism Negative Pole (N- Adaptive)

Aspect numbers 9 and 10 (the last two aspects in Table 4-2) named Neuroticism Positive Pole (N+) and Neuroticism Negative Pole (N-), were not bifurcated into adaptive and maladaptive forms.

This decision was taken as the Neuroticism Positive Pole (N+) was considered inherently maladaptive, and its opposite Neuroticism Negative Pole (N-) was frequently termed “Emotional Stability” in the literature and was considered inherently adaptive. Consequently, it proved conceptually difficult to measure the adaptive aspect of N+ and little evidence could be found in the literature to support this, with no clear path apparent to overcome the conceptual difficulty. However, the discussion section of this study does examine possible adaptive aspects of Neuroticism that may merit further investigation in follow-on research.

This created the eighteen scales shown in Table 4-3, made up of:

i. Sixteen scales - four each for O, C, E and A

ii. Two scales – two for N, defined as N+ Maladaptive and N- Adaptive

Study One creates a large item pool, then selects fifty-seven of the items to measure these eighteen scales. The instrument created will be referred to from this point on as the “BF57”. Once the fifty-seven items had been selected, the ten aspects were given names as a convenient short hand. The names were based on a combination of understanding the item content within each scale and a thorough literature review of how other researchers named scales, such as Hogan and Hogan (1995), McCrae and Costa (1999), Howard and Howard (1995), Myers and Myers (1995), Howarth and Cattell (1973) and Bartram (2005). The names of the ten aspects assigned can be found later in this section in Table 4-4.

The second objective of study one was to demonstrate the reliability of the new BF57 personality measure internally using Cronbach’s Alpha and prepare the ground for a later longitudinal study in which test-retest reliability could be assessed to highlight consistency over time.

4.1.2 How Many Items Per Scale Should the BF57 Have?

There have been a number of personality-based short forms created in the last twenty years, such as the twenty-four item HEXACO (de Vrie, 2013). A recent comprehensive review of the short form approach counsels against the use of just one or two items per scale and argues that “slightly longer measures can substantially increase the validity of research findings without significant inconvenience to the researcher or research participants” (Credé, Harms, Niehorster & Gaye-Valentine, 2012, p. 874). De Vrie (2013, p. 10) recommends “To minimize transient errors and to optimize coverage, 3- or 4-item scales seem to offer the most optimal representation of personality constructs, while still keeping answering times as short as possible.”

Recent evidence has also highlighted that short scales made up of one to five items, can have comparable criterion-validity to longer scales (Thalmayer, Saucier & Eigenhuis, 2011). Furthermore, others have found good performance in terms of test-retest reliability and concurrent validity with short scales (Wood, Nye & Saucier, 2010).

Hopton, Kurz, MacIver, Saville and Chester (2016, p. 117) measured effectiveness at work with four different lengths of instruments; namely with three, four, eight and thirty-six item instruments. The Cronbach’s Alphas rose from 0.67, to 0.71 to 0.83 and finally to 0.93 for the thirty-six item instrument. However, the criterion validity, measured through correlation with the Waves Styles Prediction personality instrument produced the best validity at 0.32 with the three-item instrument and the lowest validity at 0.25 with the thirty-six-item instrument. They cite this as evidence that short questionnaires can be just as valid as longer ones, and sometimes more valid. This is supported by Burisch (2012) who provides evidence that increasing the internal consistency of a measure may not confer any additional validity benefit.

Given these well researched and recent arguments, creating three or four items for each of the eighteen scales was considered practical and appropriate. Consequently, in line with these findings, the BF57 design set out to use three or four items per scale. The fifty-seven questions are designed to take five to ten minutes to complete and reduce the risk of fatigue in or drop out by participants.

To avoid an overdependence on the Cronbach's Alpha statistic as a measure of reliability via internal consistency, later studies were designed to measure temporal consistency with a test-retest study and observer 360-degree consistency to test for self-other agreement. It is acknowledged that observer 360-degree consistency is dependent on how well the observer knows the individual and this may result in the correlations being lower than the test-retest correlations.

4.1.3 Bipolar or Unipolar Items?

Goldberg (1992) contrasted the performance of one hundred adjectives designed to measure the Big Five in two formats. In the first format, the one hundred adjectives were administered as unipolar adjectives. For example, 'bold' was used to measure Extraversion, and 'timid' was used as a reversed item to measure Extraversion. Secondly, the same hundred adjectives were configured to form fifty bipolar items. Continuing with the example above, one item 'timid – bold' was used to measure Extraversion.

The research concluded that "the unipolar variables provided more univocal representations of the Big Five structure than did the bipolar scales" (Goldberg, 1992, p. 39). Consequently, it was decided to use unipolar items in this research and avoid items that measured both ends of the polarity within the same item.

4.1.4 Items to Measure Dispositional Traits and Behaviours

The adaptive forms were measured using items that measure both dispositional traits and contextual behaviours, researching the validity through the positive and negative correlations with performance at work. This involved conceptualising the adaptive form as based on both stable dispositional traits as well as behaviours shaped by role demands and the context. The maladaptive form was conceptualised as dispositional traits and behaviours, in part triggered and shaped by role conflicts.

4.1.5 An Inductive, Deductive and Criterion-Centric Approach

Measuring both ends of a polarity independently in a balanced way seeks to reduce the risk of one polarity being seen as more desirable than the other, an approach in part inspired by Jung's model of typology, which also sought to describe opposite personality types both adaptively and maladaptively.

Later studies in this thesis explore the relationship of the eighteen scales with performance at work and set out to build a predictive model and test hypotheses. In these later studies, the “Great Eight” (Kurz & Bartram, 2002; Bartram, 2005) is used as the measure of competency that occupies the criterion space in order to support criterion validation.

Using a deductive approach, the Big Five was chosen as the theoretical model of personality to use for the creation of the BF57, in order to occupy the predictor space (also known as a measure of “competency potential”). The five factors were bifurcated into ten aspects as one approach to reducing evaluative bias, as advocated by Pettersson, Mendle, Turkheimer, Horn, Ford, Simms and Clark (2014).

Eight of the ten aspects covering Openness, Conscientiousness, Agreeableness and Extraversion were then bifurcated into adaptive and maladaptive measures. As explained earlier, the two final aspects measuring Neuroticism and its opposite, Emotional Stability, were not bifurcated into adaptive and maladaptive measures.

Study one also used an inductive approach to scale development, through the use of Cronbach’s Alpha, item-to-scale total correlations and factor analysis as criteria for selecting items. Consequently, two of the three development methods outlined by Burisch (1986) were used in study one, namely, the inductive and deductive approaches. The criterion-centric approach was not used for item selection, although this method could be a useful approach for refining the instrument for use in specific work contexts in future. However, for this thesis, adopting the criterion-centric approach to item selection could preclude the creation of a more generalizable model and so was not adopted. Instead, plans were made to gather criterion data in study three, in order to validate the model.

4.1.6 Research Question and Hypotheses Tested

This study aimed to test the five-factor structure and see if it persists when the Big Five model is assessed at both ends, both adaptively and maladaptively. This is summarised by the following research question:

> **RQ1:** Is the proposed BF57 model of personality compatible with the Big Five factor structure?

The following hypotheses were tested in support of this study:

H1: An exploratory factor analysis, supported by a parallel analysis, indicates the BF57 model has five factors

H2: A confirmatory factor analysis indicates the BF57 model has five factors

4.2 Method

4.2.1 Item Pool Construction

On the basis of existing literature, a pool of 410 items was created to reflect the Big Five. In so doing, an appropriate breadth of content within each of the five factors, consistent with the need to measure both ends adaptively and maladaptively was sought. This approach involved going from the five dimensions of the Big Five, to ten aspects measuring the Big Five at each polarity separately. With hindsight towards the end of study one, each of the ten aspects was given its own name, with an obvious link to the Big Five dimension it had been derived from and the items underneath it.

In this thesis the codes “O”, “C”, “E”, “A” and “N” are used as short hand for the Big Five dimensions. A plus sign “+” is added to the code to denote the positive end of the polarity and a minus sign “-“ to denote the negative end of the polarity. The “O” Openness dimension bifurcates into “O+” and “O-“ named “Open” and “Pragmatic” respectively. The “C” Conscientiousness dimension bifurcates into “C+” and “C-“ named “Conscientious” and “Flexible” respectively. The “E” Extraversion dimension bifurcates into “E+” and “E-“ named “Extraverted” and “Introverted” respectively. The “A” Agreeableness dimension bifurcates into “A+” and “A-“ named “Agreeable” and “Direct” respectively. The “N” Neuroticism dimension bifurcates into “N+” and “N-“ named “Neurotic” and “Emotionally Stable” respectively. These are displayed in Table 4-4.

Eight of the ten aspects were measured both adaptively and maladaptively. For the final two aspects, Neuroticism was measured maladaptively, and Emotional Stability measured adaptively. This gives a total of eighteen scales, nine measuring adaptive traits and nine maladaptive traits. Given the known correlations between Neuroticism and dark side/maladaptive traits (see section 2.9 The Bright Side and

Dark Side of Personality) it was expected that the items measuring the maladaptive sides of O, C, E and A may also contain elements of Neuroticism. On this basis, some cross-loadings were to also be expected in the final model built and this is later explored in a further study in section 5.3.4 entitled “Locating the BF57 Scales in the Periodic Table”. The definition of the eighteen scales can be seen in Table 4-4. The ten aspect codes have been annotated with the digits “Ada” for Adaptive and “Mal” for Maladaptive to create eighteen codes shown in the final right hand column of Table 4-4.

The literature review had shown that across different instruments it was not uncommon for Conscientiousness to correlate with reversed Openness. For example, the unadjusted raw correlation of the NEO PI-R Openness facet “O4 Values” is -0.36 with the HPI scale Prudence that measures Conscientiousness (Costa & McCrea, 1995). Another example can be found in Bäckström et al. (2014) who correlated the IPIP-300 (a NEO PI-R based instrument) with a criterion measure of behaviour aligned with the Big Five termed “Act Frequency” (Botwin & Buss, 1989) which can be analysed to break out behaviours at both polarities. Positive Openness from the Act Frequency model correlated 0.59 with IPIP-300 Openness (Bäckström et al., 2014, p. 627). However, negative Openness from the Act Frequency was not significant in its correlation with IPIP-300 Openness, yet it did correlate 0.38 with Conscientiousness in the IPIP-300 (Bäckström et al., 2014, p. 627). Consequently, it was decided more items needed to be generated in the item pool covering low Openness due to the possible difficulty in finding items that ultimately would empirically be found to measure low Openness rather than high Conscientiousness. The 410-item pool created is shown in Appendix II: Item Pool.

4.2.2 Choice of Categories to Stratify Within the BF57 Scales

A review of the theoretical basis of other instruments was used to define categories on which to stratify the BF57 scales. Each choice of category within a scale required both ends of the polarity to be defined at the same time. For example, a sub-category of Extraversion could be “speaking out loud as you have thoughts” and the opposite category of Introversion could be “thinking through what you say before you say it”.

Table 4-4: The BF57 Eighteen Scales based on the Big Five dimensions, the Ten Aspects in adaptive and maladaptive forms

Big Five Dimension	Big Five Code	Ten Aspects	Ten Aspect Code	Adaptive or Maladaptive	Eighteen Scale Codes
Openness	O	Open	O+	Adaptive	O+ Ada
		Open	O+	Maladaptive	O+ Mal
		Pragmatic	O-	Adaptive	O- Ada
		Pragmatic	O-	Maladaptive	O- Mal
Conscientiousness	C	Conscientious	C+	Adaptive	C+ Ada
		Conscientious	C+	Maladaptive	C+ Mal
		Flexible	C-	Adaptive	C- Ada
		Flexible	C-	Maladaptive	C- Mal
Extraversion	E	Extraverted	E+	Adaptive	E+ Ada
		Extraverted	E+	Maladaptive	E+ Mal
		Introverted	E-	Adaptive	E- Ada
		Introverted	E-	Maladaptive	E- Mal
Agreeableness	A	Agreeable	A+	Adaptive	A+ Ada
		Agreeable	A+	Maladaptive	A+ Mal
		Direct	A-	Adaptive	A- Ada
		Direct	A-	Maladaptive	A- Mal
Neuroticism	N	Neurotic	N+	Maladaptive	N+ Mal
		Emotionally Stable	N-	Adaptive	N- Ada

4.2.3 Creating Items

The standards for item creation used are shown below (see Saville, 2016 for detailed guidelines on item creation). Unipolar items were created that:

i. Possessed high face validity

ii. Were brief and not unnecessarily long

iii. Used a closed format and were unambiguous

iv. Were easily comprehensible, and avoided the use of esoteric terms or complex metaphors

v. Controlled for social desirability by ensuring for adaptive items the appeal in the workplace ranged from neutral to slightly positive and for maladaptive items they would be unappealing in the workplace and viewed slightly negatively

vi. Were targeted at one of the thirty-two categories, belonging to one of the eighteen scales and in turn to one of the Big Five dimensions

vii. Avoided reverse coded items which have been shown to potentially reduce validity (Woods, 2006)

4.2.4 Avoiding Bloated Specifics

To ensure the items created reflected a suitable breadth of content, the eighteen scales were further divided into thirty-two lower level categories for the purposes of creating an item pool stratified across these thirty-two categories. It was planned to select final items for the BF57 from a broad range of all thirty-two categories. Without such an approach, a scale risks being constructed of items that may be too similar. In 1978, Cattell famously termed scales based on similar items as “bloated specifics” and explained “a very narrow specific can be blown up to the apparent status of a common factor in any given matrix by entering the experiment with several items that are close variants on the specific variable.” (Cattell, 2012. p. 289).

Sourcing items from a breadth of content does run the risk of reducing the Cronbach’s Alpha statistics for the BF57 scales. However, in the trade-off between internal reliability and validity, this research has given a higher weighting to the need for validity. This approach is supported by de Vries (2013) who when creating a twenty-four item brief HEXACO instrument highlighted “… higher alpha reliability levels found in other studies that have employed short personality scales (e.g., Donnellan et al., 2006) may be partly due to the use of “narrower” trait items. This may, in turn, reduce the coverage of the personality domain and increase the chance of transient errors.” (p. 20).

4.2.5 Creation of the Categories

Utilising the known correlations between the Great Eight and a number of well validated personality measures (Bartram, 2005; Saville et al., 2009; Hogan & Hogan, 1995; McCrae & Costa, 1999; Howarth & Cattell, 1973), categories beneath the Big Five polarities were defined for BF57 item pool generation. This process builds in a criterion-centric element to the design of the BF57 instrument.

Owing to the inherent bias towards one polarity in the existing instruments, it was necessary to use the existing criterion data as a guide for generating likely criterion-centric categories, whilst simultaneously finding valid evidence to enable the definition of an opposite category.

The Big Five codes O, C, E, A and N were augmented firstly with a "+" or "-" to indicate the polarity, and then with a number 1, 2, 3 or 4 to signify a different category. For example, O+1 refers to the first of the three categories of Openness and E-2 refers to the second of the three categories of Introversion. A summary of these categories can be seen in Table 4-5.

Below are examples illustrating in detail how the definitions of the categories for Openness were arrived at. This process is partly criterion-centric in the selection of categories that are known to predict performance, and partly deductive through the requirement to measure both ends of the Big Five polarities in a balanced way.

O+1 was defined as: enjoying dealing with highly complex problems; interested in having a good theoretical understanding of things; strong conceptual thinking skills; comfortable working with abstract ideas. This was summarised as theoretical, conceptual and abstract. This is based on the OPQ32 trait of "conceptual" and the 16PF trait of "abstractedness" being valid predictors of "Analysing and Interpreting".

O-1 was defined as: having good common sense; being practical and realistic; being pragmatic and down to earth; enjoying working on activities that are concrete and real. This was summarised as sensible, down to earth and realistic. This is based on the WSQ trait of "practical" and the reversed 16PF trait of "abstractedness" being valid predictors of "Analysing and Interpreting".

O+2 was defined as: enjoying being the source of new ideas; being creative and innovative; possessing a strong imagination. This was summarised as innovative, creative and idea generating. This is based on the OPQ32 trait of “innovative” and the Wave Professional Dimension of “inventive” being valid predictors of “Creating and Conceptualising”.

O-2 was defined as: focussing on the details; gathering facts and information before decision making; looking for evidence before taking on new ideas; being sensibly sceptical. This was summarised as detailed, factual and meticulous. This is based on the Wave Focus facet of “Detail Focused” and the OPQ32 trait of “detail conscious” being valid predictors of “Organising and Executing”.

O+3 was defined as: enjoying challenging the status quo; being pushy with new ideas; striving to be radical and break with tradition. This was summarised as challenging, change orientated and radical. This is based on the Saville PP trait of “unconventional” and the reversed OPQ32 trait of “conventional” being valid predictors of “Creating and Conceptualising”.

O-3 was defined as: having a cautious approach to life; wanting to work with tried and tested methods; controlling impulses and not taking risks. This was summarised as risk averse, cautious and change resistant. This is based on the HPI HIC of “impulse control” and the “deliberation” facet from the NEO-PI-R being valid predictors of “Organising and Executing”.

4.2.6 Illustration of Item Creation Process

The broad Big Five dimension of Extraversion was bifurcated into items measuring Extraversion and Introversion.

It was then divided further into items measuring:

i. Adaptive Extraversion
ii. Maladaptive Extraversion
iii. Adaptive Introversion
iv. Maladaptive Introversion

To ensure a breadth of content in the item pool for each of the four above scales, the items for both Adaptive and Maladaptive Extraversion were created to cover the realms of:

i. Talkative, Sociable, Networking
ii. Animated, Shows Emotion, Lively
iii. Seizes Control, Persuasive, Leading

For Introversion, the three realms covered were:

i. Thinks Before Speaking, Notices Thoughts
ii. Contained, Serious, Measured
iii. Listens Before Speaking, Quiet in Groups

4.2.7 Example of Extraversion Items for E+1 / E-1 Categories

i. Extraversion: Talkative, Sociable, Networking: Adaptive: “I make new friends easily”
ii. Extraversion: Talkative, Sociable, Networking: Maladaptive: “Sometimes I talk too much”
iii. Introversion: Thinks Before Speaking, Notices Thoughts: Adaptive: “I choose my words carefully before I speak”
iv. Introversion: Thinks Before Speaking, Notices Thoughts: Maladaptive: “Sometimes I listen too much and don’t give my view”

Table 4-5: The thirty-two lower level categories and their relationship to the Big Five

Big Five Dimension	Ten Aspects	Items to cover lower level categories	Code
Openness	Open	Theoretical, Conceptual, Abstract	O+1
	Open	Innovative, Creative, Idea Generating	O+2
	Open	Challenging, Change Orientated, Radical	O+3
	Pragmatic	Sensible, Down to Earth, Realistic	O-1
	Pragmatic	Detailed, Factual, Meticulous	O-2
	Pragmatic	Risk Averse, Cautious, Change Resistant	O-3
Conscientiousness	Conscientious	Focused, Goal Driven, Avoiding of Distractions	C+1
	Conscientious	Planned, Organised, Ordered	C+2
	Conscientious	On time, Delivery Focused, Reliable	C+3
	Flexible	Go with the Flow, Evolving, Adaptable	C-1
	Flexible	Rule Breaking, Flexible, Process Averse	C-2
	Flexible	Seizes the Moment, Quick to Decide, Impulsive	C-3
Extraversion	Extraverted	Talkative, Sociable, Networking	E+1
	Extraverted	Animated, Shows Emotion, Lively	E+2
	Extraverted	Seizes Control, Persuasive, Leading	E+3
	Introverted	Thinks Before Speaking, Notices Thoughts	E-1
	Introverted	Contained, Appears Serious, Measured	E-2
	Introverted	Listens Before Speaking, Quiet in Groups	E-3
Agreeableness	Agreeable	Diplomatic, Avoids Conflict, Accommodating	A+1
	Agreeable	Team Player, Trusting, Supportive	A+2
	Agreeable	Altruistic, Kind, Connecting	A+3
	Direct	To the Point, Blunt, Forthright	A-1
	Direct	Wants to win, Competitive, Ego Driven	A-2
	Direct	Argumentative, Reasoned, Logical	A-3
Neuroticism	Neurotic	Moody, Intense, Sensitive to Stress	N+1
	Neurotic	Humble, Self-effacing, Shy	N+2
	Neurotic	Volatile, Impatient, Angry	N+3
	Neurotic	Worrying, Apprehensive, Concerned	N+4
	Emotionally Stable	Calm under Pressure, Resilient	N-1
	Emotionally Stable	Confident, Full of Self-Belief	N-2
	Emotionally Stable	Serene, Unemotional, Even-tempered	N-3
	Emotionally Stable	Upbeat, Can Do, Optimistic	N-4

4.2.8 Content Validity

The Big Five questionnaire created went through a pilot study phase to confirm its usability. The pilot study involved a number of academics and psychologists completing the questionnaire and providing their feedback. Refinements were made based on the pilot study and the questionnaire data gathered in this fashion was excluded from future studies.

4.2.9 Participants and Design

A convenience sample of respondents were recruited from a variety of organisations (government and commercial) predominantly in the UK, US, Canada, Mexico, Australia, South Africa, Germany, France and Belgium, though their HR (human resources) departments. Potential respondents were forwarded on-line links to a two-part (cross-sectional) questionnaire either by their HR departments or through a direct email link sent by the author with an invitation to participate. Respondents who completed the questionnaire were promised a personal report detailing their scores and personality profile along with an invitation to attend one of a number of webinars (online web seminar). In addition, anyone wishing to discuss their results on a one to one basis were offered the opportunity to do so. Initially 3,700 responded to these invitations of which 2,506 (67.7%) subsequently completed the questionnaire (N = 1686 females, mean age = 44.0, SD = 12.0; N = 820 males, mean age = 46.5, SD = 13.0).

4.2.10 Materials and Procedures

A copy of the questionnaire can be found in Appendix II: Item Pool. Data was extracted into Microsoft Excel by means of the online package Survey Gizmo (www.surveygizmo.com/). Data was then imported from Excel into SPSS version 23 for subsequent analysis.

4.2.11 Analysis

4.2.11.1 Item to Scale Total Correlations

Item to scale correlations were used in selecting the items for the instrument. Based on the item pool, any item that correlated below 0.3 with its intended scales was dropped from the pool.

4.2.11.2 Cronbach's Alpha

Cronbach's Alpha has been computed for the eighteen sales and the five dimensions to provide an overview of the reliability of the BF57. Cronbach's Alpha was also used in selecting the items for the instrument.

4.2.11.3 Exploratory Factor Analysis

In combination with item to scale total correlations and Cronbach's Alpha, Exploratory Factor Analysis (EFA) was also employed as part of the item selection process for scale construction. Once the fifty-seven items of the BF57 had been selected and the eighteen scales constructed, EFA at a scale level, supported by Parallel Analysis, was used to explore how many factors were present in the model created. The most commonly used methods for determining the number of major factors to be extracted from a Principal Component and Exploratory Factor Analysis are Catell's Scree test or Kaiser's rule (selection of eigenvalues greater than one). However, both these have been criticised on a number of grounds (Zwick & Velicer, 1986; Fabrigar, Wegener, MacCallum & Strahan, 1999) and are increasingly not recommended. Horn's (1965) Parallel Analysis, utilised here, is currently considered the most accurate (Ledesma & Valero-Mora, 2007). It is a Monte Carlo simulation technique that compares observed eigenvalues extracted from a correlation matrix to be analysed to those obtained from a random set of uncorrelated normal variables. The current recommendation is to choose factors where the observed eigenvalue from a Principal Component Analysis of the researcher's own data exceeds those from the random data at the 95th percentile (Glorfeld, 1995).

4.2.11.4 Confirmatory Factor Analysis

Confirmatory factor analysis of the Big Five model of personality was conducted through a series of structural equation models (Dunn, Everitt & Pickles, 1993), analysed by maximum likelihood estimation using EQS 6.3 (Bentler & Wu, 2017) under the assumption of multivariate normality. Factor and error variances were constrained in all models. This was used to test for the presence of the Big Five in the items selected and the scales created.

4.2.11.5 Correlation Analysis Between Scales Within Each of the Five Factors

The eighteen scales were correlated with each other within the five factors in turn to establish if the correlations were so high that the full eighteen scales could not be justified. As well as this, checks were made to see if the correlations were so low, that clustering some of the scales under a factor heading could not be justified.

4.3 Results

4.3.1 Overview of the Item Pool

In line with expectations, the 410 items were spread across the ten aspects with a higher weighting being given to the number of items for Openness, breaking down across the polarities with O+ Open (46 items) and O- Pragmatic (83 items). The Neuroticism polarities had the next highest item weighting with N+ Neurotic (53 items) and N- Emotionally Stable (31 items). Agreeableness was next with A+ Agreeable (35 items) and A- Direct (32 items), followed by Conscientiousness with C+ Conscientious (32 items) and C- Flexible (33 items) and Extraversion with E+ Extraverted (32 items) and E- Introverted (33 items).

The 410-item pool is shown in Appendix II: Item Pool. The first column shows the seven-digit ‘scale code’ as previously defined. The first two digits identify the ‘Ten Aspect Code’ as defined by the fourth column in Table 4-4. These first two digits are either O+ for Open or O- for Pragmatic, C+ for Conscientious or C- for Flexible, E+ for Extraverted or E- Introverted, A+ for Agreeable or A- for Direct, N+ for Neurotic or N- for Emotionally Stable. The ‘scale code’ third digit is the category number and a definition of the first three digits combined can be found in Table 4-5. The fourth digit is always a period placed there to help make the seven-digit code more readable. Digits five, six and seven are either ‘Ada’ standing for Adaptive or ‘Mal’ standing for Maladaptive.

The second column is the item itself. The third right most column is the corrected item-to-scale correlation against the eighteen scales. That is, it is the correlation with the scale, having first removed the item from the total scale calculation. The highest item to total correlation at 0.70 was for the adaptive introverted (E- Ada) item “Others may view me as reserved”. The item intended to measure adaptive directness (A- Ada) “I am shrewd when it comes to handling people” had the lowest

item to total correlation at 0.11 and was discarded at the first analysis, along with 22 other items that correlated with their scale total below 0.3.

To further explore the nature of the 410 items and given the purpose of bifurcating the Big Five and selecting the best performing items to create a refined and balanced eighteen scale Big Five model, an exploratory factor analysis with varimax rotation was undertaken and a fixed five factors extracted. These first five factors explained 14.8%, 7.0%, 5.5%, 4.1% and 3.2% of the variance. As expected, an inspection of the items showed the items with the high item to total scale correlations on the intended scale also had a high factor loading on the intended factor.

As a precautionary measure, the factor loadings of the 23 discarded items were inspected. Of the 23 discarded items (on the basis of the item to total correlation being below 0.3), 10 of them also failed to load onto any of the five factors at 0.3 or above. A further 10 loaded above 0.3, but onto a non-intended factor and 5 appeared to be acceptable items in terms of their factor loadings onto the intended Big Five dimension, but not in terms of their item to total scale correlations. What follows is more detail on how the items were chosen and the scales constructed.

4.3.2 Scale Construction

Given the logic outlined in section 4.1.2, for each of the eighteen scales, it was intended that either 3 or 4 items per scale would be selected. To select the best items from the item pool a heuristic designed to meet the psychometric objectives was devised. Consequently, with respect to the eighteen targeted scales, item selection followed a six-stage process.

Firstly, as previously outlined, across the eighteen scales, items which failed to show an item-to-scale correlation of at least 0.3 were eliminated. This removed 23 items.

Secondly, having removed the 23 items, an EFA was run with five factors extracted and rotated to a varimax solution. The Big Five was evident in that of the 387 remaining items, 333 met the criteria of loading highest on the intended factor with an absolute factor loading above 0.3. The 54 items that failed to meet this criterion were removed from the item pool, leaving 333 items.

Thirdly, an item-to-scale correlation analysis was re-conducted on the remaining 333 items and all correlated above 0.3 with the intended scale and so no more items were removed. A further factor analysis on the 333 items confirmed that all items now loaded satisfactorily on the intended factor with all such absolute factor loadings above 0.3.

Fourthly, to mitigate the risk of any of the eighteen scales becoming a “bloated specific”, the items belonging to each of the eighteen scales were sub-divided into the categories previously defined in Table 4-5. Ideally, the items selected for each of the eighteen scales would draw on a mini item pool made up of at least one item belonging to each distinct category within the scale. If this was not possible due to a previous stage having removed all the items from a scale/category combination, then items would be drawn from another category within the same scale. This happened on one occasion in this item selection process, as the maladaptive category for A+2 had previously had all its items removed. Consequently, for the maladaptive A+ scale, instead of drawing at least 1 item from A+1, 1 item from A+2 and 1 item from A+3, the next best items from the A+1 and A+3 categories were considered as suitable replacements for the removed A+2 items. This enabled the maladaptive A+ scale to be able to have the required 3 or 4 items, whilst still mitigating any possible “bloated specific” effect, albeit to a slightly lesser degree.

Fifthly, within each scale’s mini item pool, the item with the highest item to total correlation was highlighted for visual inspection, as was any item within the same mini item pool that had an item to total correlation within 10% of the highest item. The final item choice was based on a visual inspection of the items in order to avoid any semantic repetition within or across any of the eighteen scales. On forty-six occasions, the item with highest item to total correlation was selected, and on ten occasions the item with the second highest item to total correlation was selected. So far fifty-six items had been assigned from the original item pool.

A sixth and final check reviewed the Cronbach’s Alpha of the eighteen scales and any that dipped below the minimum 0.6 standard would have further items added to their scale. This happened on one occasion, with the A- Adaptive (direct) scale requiring a fourth item to be added to its scale. This brought the total and final number of items in the instrument up to fifty-seven. In summary, the model created

had fifty-seven items measuring the eighteen scales, which are shown in Appendix III: BF57 Items by Aspect.

A further analysis of the fifty-seven items was undertaken and can be found in Appendix IV: BF57 Item Alphas and Factor Analysis and in Appendix V: BF57 Item to Big Five Correlations, both based on N = 2,506. In both appendices, the first column shows the seven-digit ‘scale code’ as previously defined in Table 4-4 and Table 4-5. The first two digits identify the ‘Ten Aspect Code’ as defined by the fourth column in Table 4-5. These first two digits are either O+ for Open or O- for Pragmatic, C+ for Conscientious or C- for Flexible, E+ for Extraverted or E- Introverted, A+ for Agreeable or A- for Direct, N+ for Neurotic or N- for Emotionally Stable. The ‘scale code’ third digit is the category number and a definition of the first three digits combined can be found in Table 4-5. The fourth digit is always a period placed there to help make the seven-digit code more readable. Digits five, six and seven are either ‘Ada’ standing for Adaptive or ‘Mal’ standing for Maladaptive.

In Appendix IV: BF57 Item Alphas and Factor Analysis, the second column is the item, and the third column the ‘Corrected Item-Total Correlation’. This is the correlation between the item and one of eighteen scales to which it has been assigned. The correlation has been ‘corrected’ in that the score for the item has been subtracted from the scale total before computing the correlation. The reason for doing this, is that if the item is included then the correlation produced will be inflated, as part of the correlation will be based on the item correlating with itself.

The fourth and fifth columns are the ‘Cronbach's Alpha if Item Deleted’ and the ‘Cronbach's Alpha if Item Not Deleted’. For all fifty-seven items, the Cronbach’s Alpha would get worse if the item was to be deleted.

Columns six, seven, eight, nine and ten show the factor loadings based on a principal components analysis, with five factors extracted and rotated to a varimax solution.

In Appendix V: BF57 Item to Big Five Correlations, the second column is the item, and the columns three through seven are the uncorrected item to total correlations. Of the fifty-seven items, all had their highest correlation with the intended Big Five higher level scale.

Furthermore, of the fifty-seven items, fifty-five had their highest absolute loading on the intended factor. Two items, “I can stick too rigidly to a plan” (C+ Mal) and “My empathy for others can cloud my judgement” (A+ Mal) had their first and second highest loadings close to a tie as they were within 0.02 of each other, but with the intended factor being the second highest loading. The items were maladaptive variants of Conscientiousness and Agreeableness respectively and both items blended with Neuroticism. Given the known correlations in the literature between dark side/maladaptive traits and Neuroticism (Hogan & Hogan, 1997), as explored in the Literature Review section 2.9 entitled “The Bright Side and Dark Side of Personality”, these cross loadings were considered acceptable and the items accepted. As a further check, the item to total scale correlations for the same items were examined and “I can stick too rigidly to a plan” correlated 0.44 with the expected Conscientiousness dimension and a lower -0.34 with Openness and 0.26 with Neuroticism. The item “My empathy for others can cloud my judgement” correlated 0.50 with the expected Agreeableness dimension and a lower 0.30 with Neuroticism. It was therefore concluded these items met the required standard.

4.3.3 EFA and Parallel Analysis on the Eighteen BF57 Scales

In the Parallel Analysis conducted here (using SPSS version 23), 1,000 data sets were randomly produced. From the analysis five factors from the Principal Component Analysis were found to have eigenvalues greater than those produced from the simulated data at the 95th percentile. Data from the first six roots are shown in the table below and this provides evidence that a five-factor model is present.

Table 4-6: Results of Parallel Analysis

Root	Raw Data	Means	95th Percentile
1	4.800	1.149	1.176
2	2.940	1.121	1.141
3	2.249	1.100	1.117
4	1.844	1.082	1.097
5	1.382	1.065	1.079
6	0.930	1.049	1.062

Note: N = 2,506, Ndata sets = 1,000, variables = 18.

Table 4-7: Factor Analyses of BF57 Eighteen Scales

Component	F1	F2	F3	F4	F5
O+ Adaptive		.89			
O+ Maladaptive		.77			
O- Adaptive		-.77			
O- Maladaptive		-.76			
C+ Adaptive				.87	
C+ Maladaptive				.63	.44
C- Adaptive				-.75	
C- Maladaptive				-.80	
E+ Adaptive	-.85				
E+ Maladaptive	-.72				
E- Adaptive	.90				
E- Maladaptive	.86				
A+ Adaptive			-.82		
A+ Maladaptive			-.65		
A- Adaptive			.79		
A- Maladaptive			.83		
N+ Maladaptive					.85
N- Adaptive					-.79

Note: N = 2,506; Absolute Factor Loadings below 0.4 not displayed.

Table 4-7 depicts a model very close to one in which there is complete independence of the five factors. That is, except for C+ Maladaptive, each scale is unique to a given factor. Consequently, in the following confirmatory factor analysis, for reasons of parsimony, it made sense to begin by testing the model of complete independence.

4.3.4 Confirmatory Factor Analysis

In the first model (Figure 4-1 below), complete independence of the five factors was assumed with unique contributions of a factor to all its scales. A variety of fit indices are usually given for an appropriate SEM model to fit the data well – a non-significant chi-square value, a comparative fit index (CFI) above 0.95 and a root mean square error of approximation (RMSEA) below or close to 0.06 (Hu & Bentler, 1999). As chi-square values are heavily dependent on sample size, where large sample sizes are employed, as in the current study (N = 2,506), it is usual for good fitting models

to still be statistically significant. Consequently, greater weight is given here to the other fit indices. Analysis indicated all equality constraints were correctly imposed. SPSS syntax for undertaking the analysis can be found here:

https://people.ok.ubc.ca/brioconn/nfactors/rawpar.sps

This first model detailed in Figure 4-1 failed to produce a satisfactory fit to the data X^2 = 5521.85 (df = 126), p<0.005, CFI = 0.79, RMSEA = 0.131 (90% CI = 0.128-0.134). For the subsequent model Lagrange multiplier tests, together with information form the correlation matrix (see Appendix VI: BF57 Big Five Dimensions Correlation Matrix) supported by knowledge gleaned from the existing literature were employed to suggest additional pathways which would improve fit.

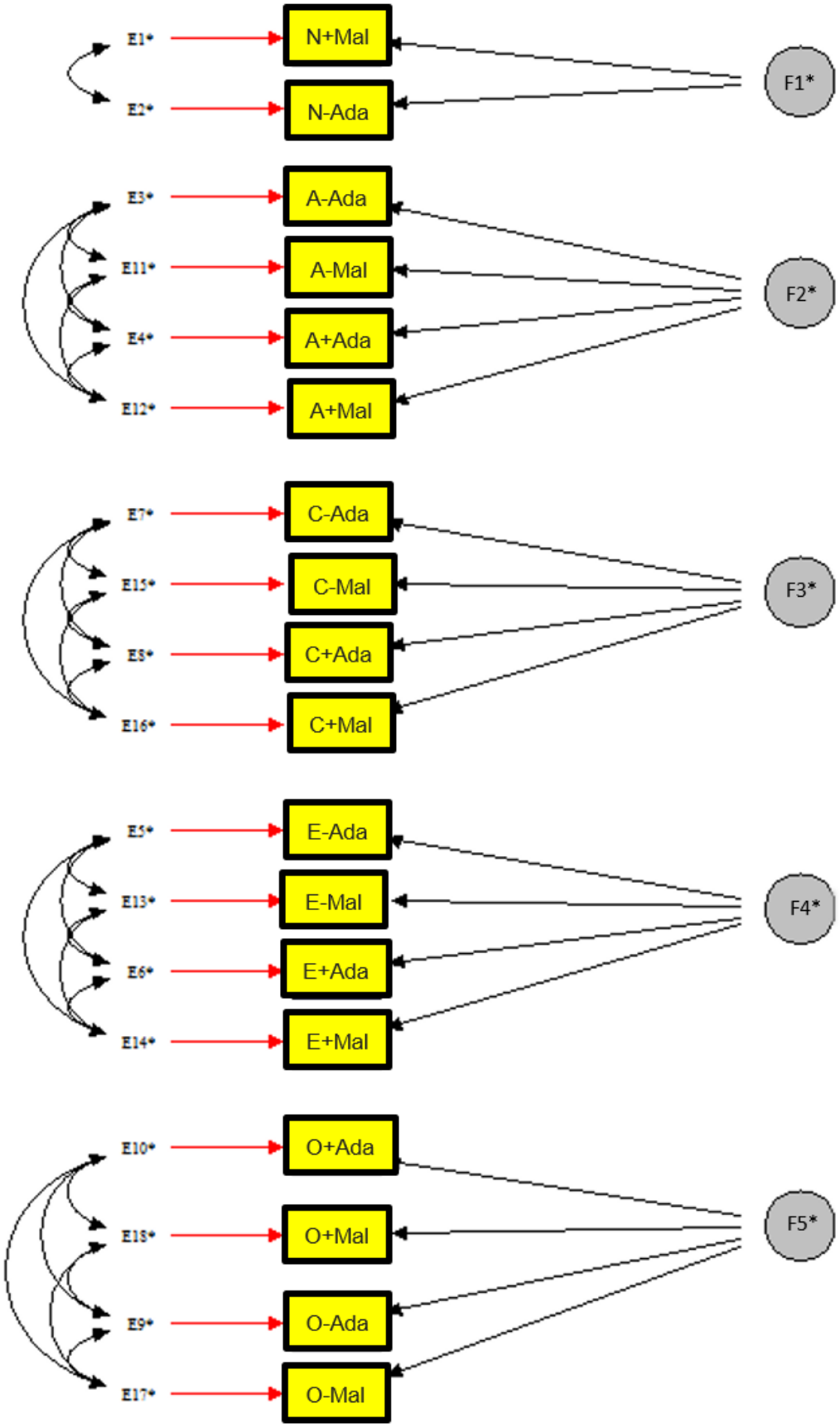

Figure 4-1: Five factor model of personality – with all factors independent.

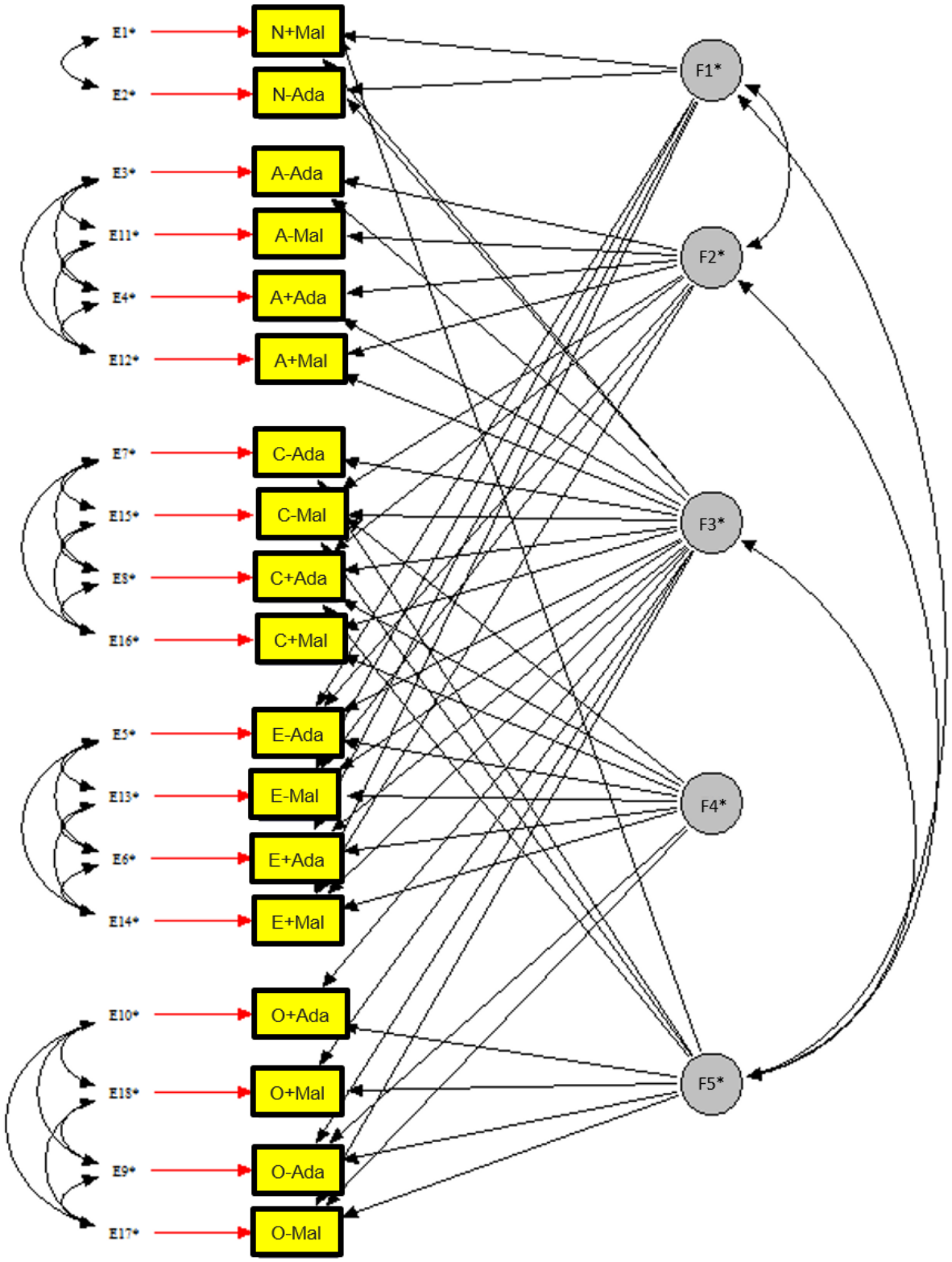

Figure 4-2: Five factor model of personality – with factors correlated.

This led to the construction of a second model displayed in Figure 4-2. This led to a substantially improved and good fitting model $X^2 = 1294.70$ (df = 91), p<0.005, CFI = 0.95, RMSEA = 0.07 (90% CI = 0.069-0.076). The standardised regression coefficients for this model are given in Table 4-8 below.

Table 4-8: Standardised regression coefficients for Five Factor model of personality – with factors correlated

	F1	F2	F3	F4	F5	R^2
O+ Adaptive			-0.34		0.46	0.30
O+ Maladaptive			-0.06		0.63	0.39
O- Adaptive			0.35	0.29	-0.17	0.23
O- Maladaptive			0.42	0.22	-0.15	0.23
C+ Adaptive		0.27	-0.13	0.40	-0.43	0.28
C+ Maladaptive			0.38	0.34		0.26
C- Adaptive					0.31	0.09
C- Maladaptive		-0.14	0.36	-0.19	0.45	0.33
E+ Adaptive	-0.40		-0.39	-0.25		0.38
E+ Maladaptive	-0.13	0.65	-0.14	-0.20		0.40
E- Adaptive	0.56	-0.47	0.41	0.35		0.52
E- Maladaptive	0.15	-0.04	0.46	0.37		0.36
A+ Adaptive		-0.25	0.15			0.08
A+ Maladaptive		-0.13	0.54			0.31
A- Adaptive		0.37	-0.26			0.21
A- Maladaptive		0.64				0.41
N+ Maladaptive			0.78			0.61
N- Adaptive	0.16		-0.59			0.37
F1		0.56			0.45	
F2	0.56				0.73	
F3					0.10	

*Notes: N = 2,506; Standardised coefficients. Largest coefficients for each factor (>0.30) are shaded; Across the eighteen scales, only regression coefficients significant at * p<0.05 are displayed.*

The model thus explained between 8% and 61% of the variance of the various scales. Given the correlation observed between the factors a variety of four-factor models were also assessed for goodness of fit.

Model 3.1 X^2 = 1598 (df = 99), p<0.005, CFI = 0.94, RMSEA = 0.08 (90% CI = 0.074-0.081).

Model 3.2 X^2 = 2543.20 (df = 102), p<0.005, CFI = 0.90, RMSEA = 0.10 (90% CI = 0.094-0.101).

Model 3.3 X^2 = 2853.20 (df = 109), p<0.005, CFI = 0.89, RMSEA = 0.10 (90% CI = 0.097-0.103).

Model 3.4 X^2 = 1742.20 (df = 100), p<0.005, CFI = 0.94, RMSEA = 0.08 (90% CI = 0.078-0.084).

Model 3.5 X^2 = 2343.90 (df = 102), p<0.005, CFI = 0.91, RMSEA = 0.09 (90% CI = 0.090-097).

Chi-square difference tests found all four-factor models had significantly poorer fit than the five-factor model, although two did show reasonably good levels of fit (CFI = 0.94, RMSEA = 0.08). The difference tests are given here for these two models (Model 3.1 X^2diff = 302.30, df = 8, p<0.005; Model 3.4 X^2diff = 447.50, df = 7, p<0.005).

4.3.5 Cronbach's Alphas on BF57 5 Dimensions and 18 Scales

Table 4-9: Cronbach's Alpha for the Big Five dimensions of the BF57

	Cronbach's Alpha
BF57 O	α = 0.85
BF57 C	α = 0.79
BF57 E	α = 0.88
BF57 A	α = 0.80
BF57 N	α = 0.81

Notes: N = 2,506.

Table 4-10: Cronbach's Alpha for the Eighteen Scales of BF57

	Cronbach's Alpha
BF57 O+ Adaptive	0.75
BF57 O+ Maladaptive	0.77
BF57 O- Adaptive	0.74
BF57 O- Maladaptive	0.68
BF57 C+ Adaptive	0.70
BF57 C+ Maladaptive	0.61
BF57 C- Adaptive	0.64
BF57 C- Maladaptive	0.72
BF57 E+ Adaptive	0.73
BF57 E+ Maladaptive	0.72
BF57 E- Adaptive	0.79
BF57 E- Maladaptive	0.68
BF57 A+ Adaptive	0.61
BF57 A+ Maladaptive	0.65
BF57 A- Adaptive	0.63
BF57 A- Maladaptive	0.74
BF57 N+ Maladaptive	0.79
BF57 N- Adaptive	0.66
Overall average	**0.70**

Notes: N = 2,506.

4.3.6 Correlation Analysis Within Each of the 5 Factors

Table 4-11, Table 4-12, Table 4-13, Table 4-14, and Table 4-15 below show the pattern of correlations between the scales within each of the Big Five domains in turn. As can be seen and in line with expectations, within each of the Big Five domains, all the scales are significantly inter-correlated.

Table 4-11: BF57 Agreeableness Correlations

	A- Adaptive	A+ Adaptive	A- Maladaptive	A+ Maladaptive
A- Adaptive	1			
A+ Adaptive	-.49**	1		
A- Maladaptive	.61**	-.55**	1	
A+ Maladaptive	-.50**	.52**	-.37**	1

*Note: N = 2,506; * p<0.05 ** p<0.01 (2-tailed)*

The proportion of shared variance between any two sub-scales of Agreeableness ranges from 14% to 37.7%.

Table 4-12: BF57 Extraversion Correlations

	E- Adaptive	E+ Adaptive	E- Maladaptive	E+ Maladaptive
E- Adaptive	1			
E+ Adaptive	-.73**	1		
E- Maladaptive	.77**	-.67**	1	
E+ Maladaptive	-.60**	.63**	-.47**	1

*Note: N = 2,506; * p<0.05 ** p<0.01 (2-tailed)*

The proportion of shared variance between any two sub-scales of Extraversion ranges from 22% to 58.8%.

Table 4-13: BF57 Conscientiousness Correlations

	C- Adaptive	C+ Adaptive	C- Maladaptive	C+ Maladaptive
C- Adaptive	1			
C+ Adaptive	-.50**	1		
C- Maladaptive	.52**	-.67**	1	
C+ Maladaptive	-.43**	.48**	-.26**	1

*Note: N = 2,506; * p<0.05 ** p<0.01 (2-tailed)*

The proportion of shared variance between any two sub-scales of Conscientiousness ranges from 6.5% to 45%.

Table 4-14: BF57 Openness Correlations

	O- Adaptive	O+ Adaptive	O- Maladaptive	O+ Maladaptive
O- Adaptive	1			
O+ Adaptive	-.69**	1		
O- Maladaptive	.67**	-.68**	1	
O+ Maladaptive	-.46**	.64**	-.42**	1

*Note: N = 2,506; * p<0.05 ** p<0.01 (2-tailed)*

The proportion of shared variance between any two sub-scales for Openness ranges from 17.6% to 47.6%.

Table 4-15: BF57 Neuroticism Correlations

	N- Adaptive	N+ Maladaptive
N- Adaptive	1	
N+ Maladaptive	-.72**	1

*Note: N = 2,506; * p<0.05 ** p<0.01 (2-tailed)*

The shared variance between Neuroticism and Emotional Stability is 50.6%.

The above pattern of correlations shows all of the adaptive and maladaptive measures of each polarity correlate either moderately or highly (r>0.48 in all cases). This was also true for the correlations across polarities. The lowest of these was the correlation of -0.27 between positive Conscientiousness (measured maladaptively) and negative Conscientiousness (also measured maladaptively).

Whilst all the scales, as aspects of a common factor, are inter-correlated, the proportion of shared variance between any two measures across the tables ranges from 6.5% to 58.8%, indicating that they cannot be considered to be measuring exactly the same thing i.e. the scales can be considered distinct attributes.

This confirms the validity of measuring both polarities in adaptive and maladaptive forms.

Appendix VI: BF57 Big Five Dimensions Correlation Matrix shows the pattern of correlations both inside and between the dimensions. In line with expectations based on other Big Five models known dimensional correlations (Costa & McCrae, 1992), BF57 Openness correlates with reversed Conscientiousness with r = -0.34, and Extraversion correlates with Openness with r = 0.32 as suggested by Digman (1997) as per the Beta higher order factor. Also in line with expectations, Extraversion correlated with Neuroticism with r = -0.22. However, none of the correlations across Big Five dimensions are so strong as to threaten their status as separate factors, neither do they exceed the criteria for collinearity (r > 0.70; Tabachnick & Fidell, 1996).

Appendix VII: BF57 Eighteen Scales Correlation Matrix shows the pattern of correlations at the next level down. The correlations are used in Study Two: convergent and divergent validity of the BF57 and Study Three: The criterion validity of the BF57 in order to test hypotheses that there are differential validities between the adaptive and maladaptive scales when compared to other personality instruments and with 360-feedback feedback based on competency models.

4.4 Study One Discussion

Table 4-16: Summary of Study One Hypotheses

Hypothesis	**Outcome**
H1: An exploratory factor analysis, supported by a parallel analysis, indicates the BF57 model has five factors	Supported
H2: A confirmatory factor analysis indicates the BF57 model has five factors	Supported

Both hypotheses were tested and found to be supported in this study. This study set out to develop a new personality instrument that measures both ends of the Big Five dimensions independently, creating ten aspects. It then set out to bifurcate eight of the ten aspects into adaptive and maladaptive measures. The instrument has been successfully created and termed the BF57.

The reliability of the new instrument has been demonstrated with reasonable Cronbach's Alpha across the eighteen scales (mean = 0.7). The Big Five structure

has been found to hold true when measured across these eighteen scales, as verified by both exploratory and confirmatory factor analysis. Further analysis follows in support of the affirmation of these hypotheses.

4.4.1 CFA and the Underlying Structure of the Big Five

The preceding analyses provide strong support for a five-factor model. A pure five-factor based on complete independence of the factors is, however, not supported. The factors are still interpretable in terms broadly similar to the conventional Big Five, though with some important differences. An examination of Table 4-8 suggests several of the factors (and the scales) are correlated. Factor one can be considered as Introversion versus Extraversion. Factor two can be considered as assessing Directness (disAgreeableness) and Extraversion versus Agreeableness. Factor three is interpreted as Neuroticism versus Emotional Stability. Factor four as Conscientiousness and Introversion versus Flexibility and Extraversion and finally, factor five as Openness and Flexibility vs Pragmatism and Conscientiousness.

Table 4-17: Summary of Factor Descriptions from Confirmatory Factor Analysis

Factor	**Factor Descriptor – negative regression coefficient**	**Factor Descriptor – positive regression coefficient**
F1	Extraversion (E+)	Introversion (E-)
F2	Agreeableness (A+)	Directness & Extraversion (A- & E-)
F3	Emotional Stability (N-)	Neuroticism (N+) (There is also a suggestion of a general factor for Maladaptive traits based on Neuroticism).
F4	Flexibility & Extraversion (C- & E+)	Conscientiousness & Introversion (C+ & E-)
F5	Pragmatism & Conscientiousness (O- & C+)	Openness & Flexibility (O+ & C-)

The ‘blending’ of factors finds some support in Digman’s (1997) work in which he proposed two higher order factors (Alpha and Beta) sitting above the Big Five. Digman’s (1997) suggestion that Openness and Extraversion form a higher order factor (Beta) finds some support in the correlation between the Big Five dimensions

of 0.32 (see Appendix VIII: BF57 Eighteen Scales Correlation Matrix) and in the results of the confirmatory factor analysis where the four Openness / Pragmatic scales and the four Extraversion / Introversion scales all load onto factor three in a manner consistent with Digman's postulated Beta factor. However, little evidence was found in support of the Alpha factor. Contrary to Digman's findings, Agreeableness had a low negative correlation with Conscientiousness (r = -0.06) (see Appendix VIII: BF57 Eighteen Scales Correlation Matrix).

In a confirmatory analysis of their seven-factor model Hogan and & Hogan (2007) constrains cross factor loading to zero and hence does not permit an empirical evaluation of the relationship between factors. In addition, his analyses are rendered problematic by the failure to provide fit indices other than an unstandardised root mean square error of approximation (RMSEA) constructing the factors in his model to have no measurement error - a practice which can lead to inflation in the estimation of mode parameters (Guenole & Brown, 2014).

Owing to the correlational structure, a variety of four-factor models were explored in confirmatory analyses of the current data. None of the fit indices for these models were as good as those found for the five-factor model. The high comparative fit index and low standardised RMSEA found for the five-factor model despite the large sample size can be favourably compared with the relatively few confirmatory analyses of the Big Five which have conformed to Guenole, Brown and Cooper's (2016) recommendations regarding specification of measurement error (the current study complied with this recommendation). These include the analysis by Ashton et al. (2014) which, like the current analysis, utilised lower level scales beneath the factors. These authors, however, confined their confirmatory analysis to two factors only – using Conscientiousness and Humility to predict delinquency.

While exploratory factor analyses have generally been successful at extracting the five factors from self-report data, confirmatory factor analyses have often failed to adequately model this structure (Church & Burke, 1994). A confirmatory factor analysis of the Big Five by Leung, Wong, Chan & Lam (2012) in a Chinese sample, despite the claims of the authors, did not find a satisfactory fit - their best fitting model achieving a comparative fit index of less than 0.85. Leung et al.'s (2012)

model in fact entails a poorer fit despite employing a smaller sample size (n < 1,000) and a simpler model than the current study.

Similarly, Donnellan, Oswald, Baird & Lucas (2006) used confirmatory factor analysis to test the Mini-IPIP as part of the scale development, and found only poor to modest overall model fit although it did show superior model fit to plausible four and two factor confirmatory models. They further reported that the model modification indices indicated model fit would have been improved by freeing cross loadings for several items. It remains true that although supported by an impressive body of research employing exploratory factor analysis (see McCrae & Costa, 1997), confirmatory analyses have largely failed to replicate these findings. McCrae, Zonderman, Costa, Bond and Paunonen (1996, p. 568) concluded, "In actual analyses of personality data [...] structures that are known to be reliable showed poor fits when evaluated by CFA techniques. We believe this points to serious problems with CFA itself."

The problems which McCrae et al. (1996) draws attention to may well stem from several issues which are not intrinsic to confirmatory analyses but pertain to model specification (an insistence on the absolute independence of the Big Five factors) and measurement (lack of sufficient reliability, and breadth of item selection, as well as failure to adequately differentiate factors). Thus, when these problems are specifically addressed as here – the confirmatory model produced good fit indices. It can be argued that researchers need to move away from simplistic conceptions of the Big Five, embracing the conceptual breadth underlying the five dimensions and accepting that the scales and facets beneath them may not be uniquely related to a single factor and that the factors themselves may be correlated. This of course requires a more complex model specification but given the advances in statistical methodology in recent years it is now possible and necessary that such different conceptualizations of the five major factors of personality can be rigorously tested as a matter of course.

4.4.2 Measuring Opposites

The BF57 purports to measure opposites, such as A+ Adaptive (e.g. being agreeable and diplomatic) and A- Adaptive (e.g. being direct and to the point). This merits some exploration, as although common sense may suggest they sound

opposite, there is always a need to confirm empirically such assumptions. For example, until Costa and McCrae (1980) and Watson and Tellegen (1985) gathered empirical evidence, many people assumed a trait such as “expresses positive emotion” would have an opposite of “expresses negative emotion”. They found that these two traits are not opposites at all and in fact are largely independent of each other. This does highlight a risk with any personality model that employs bi-polar items, as unless there is strong evidence the opposite poles of a bipolar item really are opposites, there is a risk of inflicting a false dichotomy on the test taker. Instruments such as the MBTI use bipolar items and other researchers such as Cote and Miners (2006) have suggested, for example, that the ‘thinking / feeling’ Jungian preference are not true opposites. They highlighted how people stronger in logic and reasoning skills (i.e. thinking) can also be better at recognizing, understanding and managing emotions (i.e. feeling), and that this can support positive performance at work.

It is naturally easier to define an opposite in an evaluatively unbalanced way. For example, the opposite of “agreeable and kind” could be “disagreeable and harsh”. The BF57 is, however, striving to avoid building such evaluative bias into the instrument. The approach adopted is to measure items in a unipolar fashion, which in this example would imply two separate items such as:

i. “I tend to be agreeable and kind” with the test taker likely assuming the opposite end of the scale means “I am not so agreeable and kind”
ii. “I tend to be disagreeable and harsh” with the test taker likely assuming the opposite end of the scale means “I am not so disagreeable and harsh”.

The BF57 approach would deem the item “I tend to be agreeable and kind” as adaptive and the item “I tend to be disagreeable and harsh” as maladaptive. To fully balance the items, two more items are needed such as:

i. “I tend to be too agreeable and don’t speak my mind” (maladaptive) and
ii. “I tend to be direct and speak my mind” (adaptive)

Analysis of Table 4-11, Table 4-12, Table 4-13 and Table 4-14 is one way of validating how opposite the BF57 scales actually are. For example, Table 4-13

shows being Conscientious (C+ Adaptive) is opposite to being Flexible (C- Adaptive) only to the extent that it correlates negatively at -0.50. If the negative correlation was much lower, the case for them being opposites is lost. However, if the negative correlation was much higher, the case for two scales is lost and the principal of parsimony would suggest only one scale is required.

None of the assumed BF57 opposites have been empirically found to not be opposites in the manner that “expressing positive emotion” and the debunked opposite of “expressing negative emotion” have.

Figure 4.3 demonstrates graphically some of these concepts and is inspired by the work of Siegling, Petrides and Martskvishvi (2014). The large ovals represent three of the Big Five dimensions. Trait 1 could be “expressing negative emotion” and has common variance with Neuroticism. It is not an opposite of, and does not share any common variance with trait 2 “expressing positive emotion” which is correctly located inside the Extraversion construct.

Trait 3 and trait 4 both belong to Agreeableness and share common variance. They could be “opposite” poles such as “agreeable and kind” and “direct and speak my mind”. As opposites designed to reduce evaluative bias and enhance user validity, some overlap is designed into the idea.

Whereas traits 3 and 4 are “factor pure”, trait 5 is a factor blended trait. It loads most onto Extraversion, yet has a secondary loading on Agreeableness, symbolised by the code E+A+. This concept is explored further in sections 5.2.3, 5.2.4 and 5.3.5 which locate the BF57 scales on the periodic table (Woods & Anderson, 2016) designed to show both “factor pure” and “blended factors”. E+A+ is termed “Affiliation” in Woods’ and Anderson’s (2016) periodic table.

Trait 6 is termed “extraneous” by Siegling et al. (2014). Extraneous traits “have no common variance at all (i.e. variance due to target construct); their variance is due to dimensions other than the one reflecting the target construct.” (p. 2).

Traits 7 and 9 share some common variance, but have enough unique variance each to merit their own existence. Trait 8, however, is termed “redundant” by Siegling et al. (2014) as its variance can more helpfully be covered by another trait

(in this case traits 7 and 9). Siegling et al. (2014) have developed a new psychometric method termed “Facet Benchmarking” that can operationalise the ideas in Figure 4.3 and help understand how the trails in a model relate to each other and their higher order factors. This is one possible further research direction for further understanding and developing the BF57.

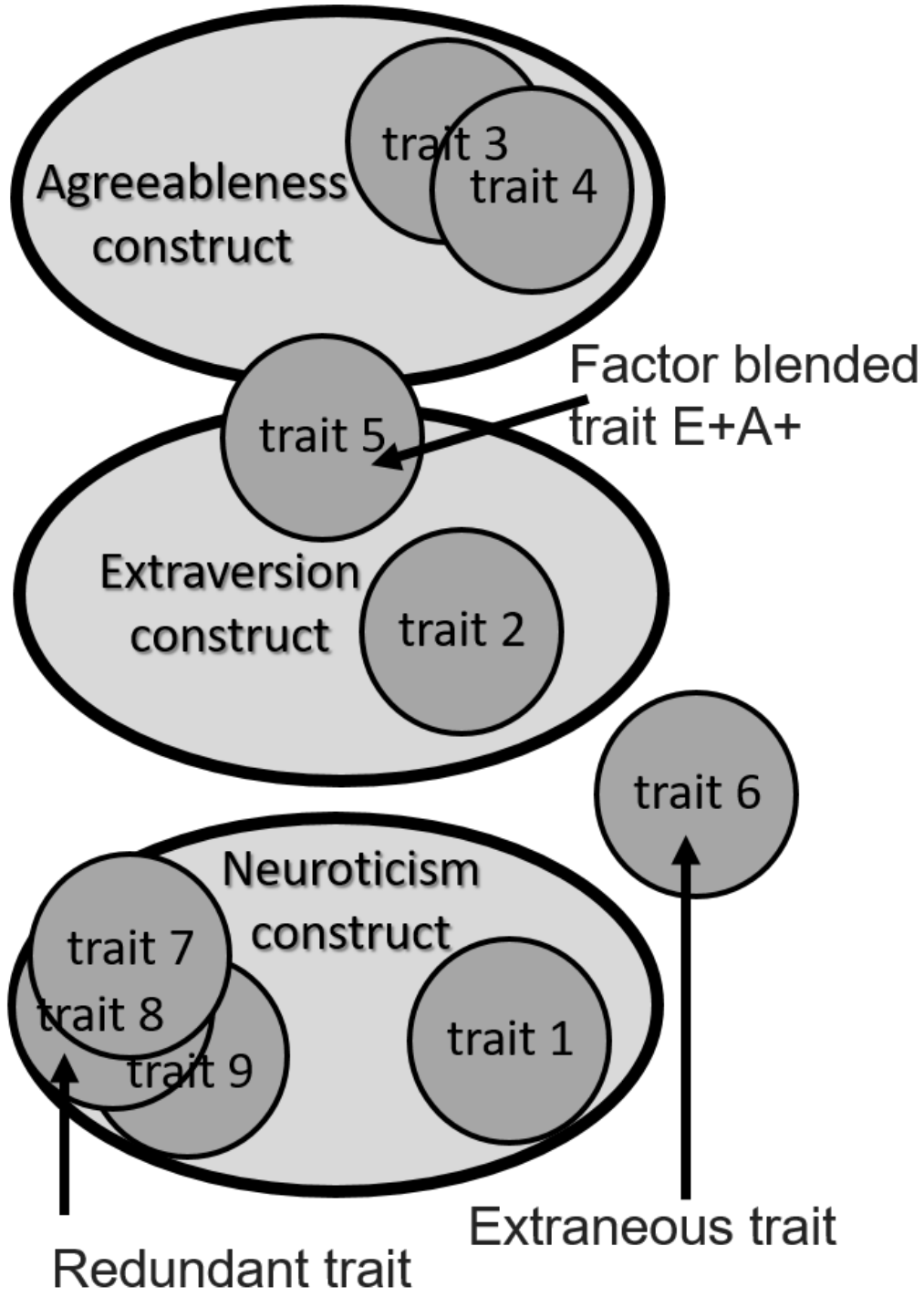

Figure 4.3: Traits within a construct

4.4.3 Limitations of This Study

There were a number of limitations to this study. For example, the sample size of 2,506 is acceptable, but the sample had a slight gender bias, with 1,686 females and 820 men. This may be due to the convenient sample accessing senior people in organisation often via the HR departments which also had a higher percentage of women in them, particularly in learning and development roles. However, given the relatively small differences between men and women in personality terms, this was not considered a critical shortcoming for the study's analysis. There was also no longitudinal aspect to study one or an attempt to revalidate the model on a second sample. Consequently, these activities were planned in for a future study as part of this research.

4.4.4 Conclusion

It has been possible to measure both ends of the Big Five, with the intention of adjusting for social desirability and reducing evaluative bias. This has proved effective in terms of construct validity based on exploratory and confirmatory factor analysis, as well as correlational analysis.

Future studies will ascertain the effectiveness of the questionnaire in terms of convergent and divergent validity, as well as criterion validity and a study to quantify the potential reduction in any bias achieved.

5 STUDY TWO: CONVERGENT AND DIVERGENT VALIDITY OF THE BF57

5.1 Introduction

In this study, hypothesised relationships between the BF57 and other instruments are tested. Data from several existing recognised measures of the Big Five was gathered and compared with the BF57 instrument data. Namely: the IPIP-NEO (Johnson, 2014); the Hogan Personality Inventory or HPI (Hogan & Hogan, 1995); the Hogan Development Survey or HDS (Hogan & Hogan, 1997); and the Trait Descriptive Adjectives or TDA (Goldberg, 1992).

In line with expectations, an inspection of the IPIP-NEO, Hogan Personality Inventory (HPI) and Trait Descriptive Adjectives (TDA) items suggested the positive polarities of Agreeableness, Conscientiousness, Extraversion and Openness are measured in a more socially desirable way (mainly in a neutral or adaptive form) than their opposite polarity.

5.1.1 Research Questions Addressed

This study sought to answer the following four research questions:

RQ1: Is the proposed BF57 model of personality compatible with the Big Five factor structure?

RQ2: Where do the BF57 scales sit in the personality periodic table (Woods & Anderson, 2016) of blended Big Five factors?

RQ3: Do the BF57 adaptive scales correlate more highly than the BF57 maladaptive scales, with other “bright side” Big Five traits?

RQ4: Do the BF57’s maladaptive scales correlate more highly than the BF57 adaptive scales, with the HDS “dark side” traits?

5.1.2 Hypotheses Tested

To help answer the research questions it was hypothesised that the correlations between the BF57 Big Five and the corresponding dimension of the TDA, IPIP-NEO and HPI instruments will offer good evidence of convergent validity. In particular:

H3: BF57 Big Five dimensions converge with TDA Big Five

H4: BF57 Big Five dimensions converge with IPIP-NEO Big Five

H5: BF57 Big Five dimensions converge with HPI Big Five

H6: Multitrait-Multimethod convergent and divergent validity with BF57, TDA, IPIP-NEO and HPI

To help answer the research questions it was hypothesised that the correlations between the BF57 and the corresponding dimension of the TDA, IPIP-NEO and HPI instruments Big Five measures will be greater for the A+ Ada, C+ Ada, E+ Ada and O+ Ada scales than the corresponding A+ Mal, C+ Mal, E+ Mal and O+ Mal scales. This is summarised as follows:

H7: TDA / IPIP-NEO / HPI correlation greater with BF57 A+ Ada than A+ Mal

H8: TDA / IPIP-NEO / HPI correlation greater with BF57 C+ Ada than C+ Mal

H9: TDA / IPIP-NEO / HPI correlation greater with BF57 E+ Ada than E+ Mal

H10: TDA / IPIP-NEO / HPI correlation greater with BF57 O+ Ada than O+ Mal

It was also hypothesised that as the Hogan Development Survey (HDS) scales purport to measure maladaptive aspects of personality, the HDS scale correlations with the maladaptive forms of the BF57 will be greater than those with the BF57 adaptive forms. To test this, one group of hypotheses examined specific BF57 scales relationship with each of the three HDS factors. The other group of hypotheses examined the relationship between all eighteen of the BF57 scales and all eleven of the HDS dark side traits.

Firstly, the HDS survey data was factor analysed and the three factors Hogan and Hogan (1997) identified as “moving against”, “moving away” and “moving towards” computed and correlated with specific *a priori* hypothesised BF57 scales. The hypotheses tested were:

H11: HDS Moving Against correlation greater with BF57 E+ Mal than E+ Ada

H12: HDS Moving Against correlation greater with BF57 O+ Mal than O+ Ada

H13: HDS Moving Away correlation greater with BF57 E- Mal than E- Ada

H14: HDS Moving Away correlation greater with BF57 A+ Mal than A+ Ada

H15: HDS Moving Toward correlation greater with BF57 C+ Mal than C+ Ada

Secondly, it was hypothesised of all HDS trait and BF57 scale correlations:

H16: of the 45 pairs of “moving away” based correlations (5 HDS scales multiplied by the 9 BF57 pairs), statistically significantly more will have a higher correlation between the maladaptive BF57 scale and the HDS scale than the adaptive BF57 scale correlation with the same HDS scale.

H17: of the 36 pairs of “moving against” based correlations (4 HDS scales multiplied by the 9 BF57 pairs), statistically significantly more will have a higher correlation between the maladaptive BF57 scale and the HDS scale than the adaptive BF57 scale correlation with the same HDS scale.

H18: of the 18 pairs of “moving toward” based correlations (2 HDS scales multiplied by the 9 BF57 pairs), statistically significantly more will have a higher correlation between the maladaptive BF57 scale and the HDS scale than the adaptive BF57 scale correlation with the same HDS scale.

5.2 Method

5.2.1 Other Instruments Used

The data was matched across the IPIP-NEO, HPI, TDA and HDS instruments via each participant providing their full name. The data was then anonymised before the analysis was undertaken. The volunteers filled in the questionnaires at times most

convenient to them in an eight-week window. Inevitably, there was some attrition of volunteers as they worked through the various instruments, which were presented to them in a varying and random order to mitigate any fatigue effects on any one instrument. 234 completed the BF57 and the IPIP-NEO. 154 completed the HPI and the BF57. 420 completed the BF57 and TDA. 138 completed the BF57 and the HDS. For the Multitrait-Multimethod analysis, 106 people had completed all of the BF57, HPI, TDA and IPIP-NEO instruments.

The item-level data could not be analysed for the HPI and HDS as these are proprietary instruments. However, as is accepted practice (Salgado, Moscoso & Alonso, 2013), the publisher did provide scale-level data for analysis. For the HPI and HDS scales provided on this basis, Alpha reliabilities have been sourced from their published technical manuals.

5.2.2 Questionnaire Response Format

The questionnaires created to operationalise the BF57 used a five-point Likert scale as did each IPIP-NEO item as advocated by Johnson (2014). The items and their scores for all participants were downloaded from the online survey package used and then analysed in SPSS version 23. The raw scores for the IPIP-NEO five dimensions and the thirty IPIP-NEO facets were computed by summing the items contained within the Big Five dimensions or lower level facets. For the Multitrait-Multimethod analysis and concurrent validity analysis, the TDA items were measured on a scale of 1 to 9 as advocated by Goldberg (1992) and the Big Five dimensions computed as with the IPIP-NEO. An analysis based on the TDA regression scored factors was also undertaken to enable the BF57 scales to be located within the “periodic table” (Woods & Anderson, 2016).

The Hogan Personality Inventory (HPI) and Hogan Development Survey (HDS) items used a true / false response format and raw scores were computed by their publisher, Hogan Assessment Systems, Tulsa, USA.

5.2.3 Mapping the BF57 onto the TDA Based Periodic Table

Woods and Anderson (2016) suggest that in the absence of the Big Five, personality researchers in previous decades were akin to alchemists and chemists who were working before the invention of the periodic table. Acknowledging that many items

and facets can be blends of different factors, Woods and Anderson (2016) set out to measure where items/facets sit across their top two Big Five dimensions. Using the TDA as a marker for the Big Five dimensions, Woods and Anderson (2016) developed a methodology for undertaking a concurrent validity study and measuring where any other instruments' scales may sit in the periodic table. This research applied the blended factor approach and the BF57 scales location in their top two Big Five dimensions were quantified.

Using the circumplex concept the Big Five can be thought of as ten circumplexes based on paired factor combinations. For example, one circumplex for Openness by Extraversion, and one for Openness by Agreeableness and so on.

Each circular model can then be divided into twelve 30-degree segments (see Figure 2.2 from the Literature Review section of this thesis) as detailed by Hough and Ones (2001).

5.2.4 TDA Periodic Table Analysis

As advocated by Goldberg (1992) and Hofstee, De Raad and Goldberg (1992), five orthogonal factors were extracted from the TDA data (N = 420). Next the regression-scored factors from the TDA were correlated with the eighteen BF57 scales. The primary and secondary correlations for each of the eighteen scales was examined, and each of the eighteen assigned to one of the elements in the periodic table. As advocated by Hofstee et al. (1992), if the primary correlation was 3.73 or more times the secondary correlation, the scale was deemed to be "factor pure", otherwise it was assigned a "blended" description in the periodic table. The "vector length" is taken from Johnson (1994) who recommends calculating it as the square root of the sums-of-squares of the top two correlations. The vector length represents the degree to which the BF57 scale converges with the element from the periodic table.

As a sense check, the regression-scored factors from the TDA were correlated with the raw scores for the Big Five dimensions from the TDA. The BF57 Big Five dimensions were also correlated with the raw scores for the Big Five dimensions from the TDA.

5.2.5 HDS Factor Analysis

Three orthogonal factors were extracted from the HDS data (N = 138) and the regression-scored factors were then correlated with the five BF57 dimensions and the eighteen BF57 scales.

5.3 Results

5.3.1 Convergent Validity with the IPIP-NEO

In the first test, Pearson correlation coefficients were computed between the five summed dimension scores based on the eighteen scale BF57 instrument and the five dimensions from the IPIP-NEO. These are detailed in Table 5-1 below and show moderate to high correlations between each dimension of the IPIP-NEO and its respective domain from the BF57 instrument. The average correlation between these is 0.63 which is similar in magnitude to those observed in other studies assessing the convergent validity of the Big Five (e.g. Calabrese, Rudick, Simms & Clark, 2012; Zheng, Goldberg, Zheng, Zhao, Tang & Liu, 2008; Gosling, Rentfrow & Swann, 2003).

Table 5-1: Raw Correlations between the BF57 Five Dimensions and the IPIP-NEO

	NEO O	NEO C	NEO E	NEO A	NEO N
BF57 O	0.62**				
BF57 C		0.60**			
BF57 E			0.69**		
BF57 A				0.49**	
BF57 N					0.77**

*Note: Correlations > 0.40 shown, N = 234; ** p<0.0005*

None of the BF57 scales exhibit correlations above an absolute value of 0.40 with the IPIP-NEO scales, other than the expected diagonal, and this suggests good convergent and discriminant validity. However, to consider the correlations as true estimates of validity coefficients one needs to correct for the level of reliability of both the BF57 dimensions and the IPIP-NEO dimensions. Reliability coefficients for the IPIP-NEO are taken from Johnson (2014, p. 81) for which; Agreeableness (α = 0.87), Extraversion (α = 0.89), Openness (α = 0.83), Conscientiousness (α = 0.90) and Neuroticism (α = 0.90). Internal consistency for the BF57 were computed in Study One (N = 2,506) and were; for Agreeableness (α = 0.80), Extraversion (α =

0.88), Openness (α = 0.85), Conscientiousness (α = 0.79) and Neuroticism (α = 0.81). The corresponding concurrent validity coefficients corrected for measurement error are shown below (mean = 0.78).

Table 5-2: Concurrent Validity Coefficients (Corrected for Measurement Reliability) Between the BF57 Five Dimensions and the IPIP-NEO

		NEO O	**NEO C**	**NEO E**	**NEO A**	**NEO N**
		α =0.83	α =0.90	α =0.89	α =0.87	α =0.90
BF57 O	α =0.85	0.74				
BF57 C	α =0.79		0.71			
BF57 E	α =0.88			0.78		
BF57 A	α =0.80				0.59	
BF57 N	α =0.81					0.90

Note: Correlations > 0.40 shown, N = 234;

A critique of Cronbach's Alpha has suggested it may be overused and also underestimated (Harms, 2017). The calculation in SPSS for Alpha is a conservative lower bound estimate of the reliability. However, when adjusting correlation coefficients for reliability, the impact of the two scales' Alphas being slightly underestimated, could be to slightly overestimate the adjusted correlation coefficient between the variables. For this reason, the adjusted figures should be interpreted with some caution and, at the very least, with this concern in mind.

Standards for concurrent validity vary by differing review boards (Evers, Sijtsma, Lucassen & Meijer, 2010; Bartram, 1996). The BPS standard for a concurrent validity study to conclude that two variables are measuring the same thing, is a correlation coefficient of 0.45, whereas the European standard is higher at 0.55 (Evers, Hagemeister, Hostmaelingen, Lindley, Muñiz, & Sjöberg, 2013, p. 56). In Table 5-2, the unadjusted Agreeableness correlation dips below the 0.55, but adjusted rises to 0.59. Consequently, applying either standard does suggest good concurrent validity between the BF57 and IPIP-NEO.

Table 5-3: Raw Correlations BF57 Eighteen Scales with IPIP-NEO

	NEO O	NEO C	NEO E	NEO A	NEO N
O+ Adaptive	.57**	-.13	.23**	-.13*	-.23**
O+ Maladaptive	.39**	-.28**	.08	-.25**	-.02
O- Adaptive	-.60**	.18**	-.34**	-.02	.31**
O- Maladaptive	-.60**	.10	-.30**	-.07	.32**
C+ Adaptive	-.24**	.59**	.00	-.13*	.09
C+ Maladaptive	-.44**	.32**	-.27**	-.18**	.39**
C- Adaptive	.31**	-.43**	.08	.11	-.19**
C- Maladaptive	.18**	-.60**	-.01	.03	.11
E+ Adaptive	.30**	-.10	.69**	.00	-.32**
E+ Maladaptive	.23**	-.24**	.54**	-.23**	-.13*
E- Adaptive	-.14*	.13*	-.60**	.04	.27**
E- Maladaptive	-.20**	.08	-.58**	-.07	.28**
A+ Adaptive	.08	.06	.01	.47**	.03
A+ Maladaptive	-.07	-.07	-.28**	.31**	.22**
A- Adaptive	-.03	.07	.31**	-.43**	-.04
A- Maladaptive	-.03	-.15*	.15*	-.46**	.17**
N+ Maladaptive	-.09	-.22**	-.35**	-.10	.75**
N- Adaptive	.12	.32**	.37**	.05	-.67**

*Note: Correlations between 0.3 & 0.4 shaded light grey; correlations >0.4 shaded dark grey; N = 234; * p<0.05 ** p<0.01*

The hypothesised greater correlations of the A+ Ada, C+ Ada, E+ Ada and O+ Ada scales with the IPIP-NEO A, C, E and O scales, compared the A+ Mal, C+ Mal, E+ Mal and O+ Mal scales was tested. This hypothesis prediction was tested for the four dimensions of the Big Five for which versions of both adaptive and maladaptive items exist (Agreeableness, Conscientiousness, Extraversion and Openness). Steiger Z-transformations for dependent samples were undertaken to test for significant differences between the magnitude of the observed correlations for adaptive and maladaptive versions of the scales. The results are shown in Table 5-4.

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Table 5-4: Correlations between IPIP-NEO Big Five Dimensions A, C, E & O and Adaptive/Maladaptive BF57 A+, C+, E+ & O+ Dimensions

IPIP-NEO Correlation with BF57 Adaptive		NEO Correlation with BF57 Maladaptive		Steiger's Z transform, p	Hypothesis Supported
NEO A vs BF57 A+ Ada	0.47	NEO A vs BF57 A+ Mal	0.31	Z_h=2.79, p=0.005	Supported
NEO C vs BF57 C+ Ada	0.59	NEO C vs BF57 C+ Mal	0.32	Z_h=4.74, p<0.001	Supported
NEO E vs BF57 E+ Ada	0.69	NEO E vs BF57 E+ Mal	0.54	Z_h=3.59, p<0.001	Supported
NEO O vs BF57 O+ Ada	0.57	NEO O vs BF57 O+ Mal	0.39	Z_h=3.8, p<0.001	Supported

Note: N = 234 and all comparisons were statistically significant (p<0.05) in the direction predicted.

5.3.2 Convergent Validity with the HPI

The Hogan Personality Inventory (Hogan & Hogan, 1995) details seven dimensions. These are now labelled as Adjustment, Ambition, Sociability, Interpersonal Sensitivity, Prudence, Inquisitiveness and Learning Approach. Pearson correlation coefficients were computed firstly, between the five summed scale scores from the BF57 instrument and the seven dimensions of the HPI and secondly, between each of the eighteen scales from the BF57 and the seven dimensions of the HPI. The raw correlations based on the five BF57 dimensions are shown in Table 5-5.

Table 5-5: Raw Correlations of BF57 Five Dimensions with HPI

	Adjustment	Ambition	Sociability	Interpersonal Sensitivity	Prudence	Inquisitiveness	Learning Approach
BF57 O		.32**	.26**		-.39**	.36**	
BF57 C			-.26**		.51**		
BF57 E	.22**	.54**	.66**	.38**			
BF57 A		-.35**		.36**	.30**		
BF57 N	-.63**	-.55**		-.20*			

*Note: Absolute correlations > 0.20 shown N = 154; * p<0.05 ** p<0.01*

An adjustment to the correlations in Table 5-5 has been made to correct for the level of reliability of both the BF57 dimensions and the HPI dimensions and this is shown in Table 5-6. Reliability coefficients for the HPI are taken from Hogan (1995, p. 35) for which; Adjustment (α = 0.82), Ambition (α = 0.80), Sociability (α = 0.83), Interpersonal Sensitivity (α = 0.57), Prudence (α = 0.71), Inquisitiveness (α = 0.80) and Learning Approach (α = 0.78).

Table 5-6: Concurrent Validity Coefficients (Corrected for Measurement Reliability) Between the BF57 Five Dimensions and the HPI

		Adjustment	**Ambition**	**Sociability**	**Interpersonal Sensitivity**	**Prudence**	**Inquisitiveness**	**Learning Approach**
		α=0.82	α=0.80	α=0.83	α=0.57	α=0.71	α=0.80	α=0.78
BF57 O	α=0.85		.39	.31		-.50	.44	
BF57 C	α=0.79			-.32		.68		
BF57 E	α=0.88	.26	.64	.77	.54			
BF57 A	α=0.80		-.44		.53	.40		
BF57 N	α=0.81	-.77	-.68		-.29			

Note: Absolute correlations > 0.20 shown N = 154

As can be seen from the table, Agreeableness shows a positive relationship with Interpersonal Sensitivity of 0.53 and Prudence of 0.40 whilst being negatively related to Ambition at -0.44. Conscientiousness is also related to Prudence (0.66) and inversely related to Sociability (-0.32). Extraversion shows positive relationships with Adjustment at 0.26, Ambition at 0.64, Sociability at 0.77 and Interpersonal Sensitivity at 0.54. Neuroticism is inversely related to Ambition at -0.68, Adjustment at -0.77 and Interpersonal Sensitivity at -0.29. Openness to Experience is positively related to Ambition at 0.39, Sociability at 0.31 and Inquisitiveness at 0.44 and inversely related to Prudence at -0.44. No significant correlations were found with any of the five factors and Learning Approaches in the HPI.

This pattern of correlations provides further evidence for the concurrent validity of the BF57 scales. A somewhat more detailed picture emerges when we examine the

correlations between the Hogan Personality Inventory and the adaptive and maladaptive aspects of the BF57 instrument developed here (see Table 5-7).

Table 5-7: Raw Correlations BF57 Eighteen Scales with HPI

	Adjustment	Ambition	Sociability	Interpersonal Sensitivity	Prudence	Inquisitiveness	Learning Approach
O+ Adaptive	.05	.33**	.25**	.08	-.33**	.34**	.04
O+ Maladaptive	-.10	.16*	.17*	.02	-.39**	.33**	-.02
O- Adaptive	-.13	-.35**	-.24**	-.28**	.33**	-.25**	-.02
O- Maladaptive	-.10	-.29**	-.27**	-.19*	.29**	-.35**	.05
C+ Adaptive	-.03	.10	-.15	-.11	.42**	-.11	.05
C+ Maladaptive	-.18*	-.22**	-.29**	-.23**	.39**	-.19*	.01
C- Adaptive	.03	-.04	.19*	.08	-.52**	.22**	-.01
C- Maladaptive	-.10	-.18*	.23**	.17*	-.33**	.11	-.15
E+ Adaptive	.22**	.48**	.62**	.43**	-.05	.01	-.04
E+ Maladaptive	.01	.38**	.52**	.16*	-.21**	.02	-.03
E- Adaptive	-.20*	-.47**	-.58**	-.31**	.10	.06	.06
E- Maladaptive	-.36**	-.53**	-.56**	-.45**	.01	-.03	.07
A+ Adaptive	.10	-.16*	.07	.47**	.29**	-.13	-.17*
A+ Maladaptive	-.14	-.44**	-.20*	.16*	.20*	-.06	-.04
A- Adaptive	-.05	.41**	.25**	-.25**	-.19*	.25**	.18*
A- Maladaptive	-.28**	.13	.21**	-.33**	-.32**	.09	.12
N+ Maladaptive	-.63**	-.56**	-.15	-.24**	.01	-.06	-.08
N- Adaptive	.53**	.44**	.09	.12	.02	.21**	.14

*Note: Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; N = 154; * p<0.05 ** p<0.01*

The hypothesised greater correlations of the A+ Ada, C+ Ada, E+ Ada and O+ Ada scales with the HPI A, C, E (Ambition and Sociability) and O scales, compared to the A+ Mal, C+ Mal, E+ Mal and O+ Mal scales was tested. This hypothesis prediction was tested for the four dimensions of the Big Five for which versions of both adaptive and maladaptive items exist (Agreeableness, Conscientiousness, Extraversion and Openness). An updated version (Hoerger, 2013) of Steiger's (1980) Z test is used to assess the significance of these differences between the two correlation coefficients which occur in a related sample. Significant results from

this procedure are shown in both Table 5-8 and below for each of the HPI scales. All p-values refer to 2-tailed tests.

Table 5-8: Correlations between HPI Big Five Dimensions A, C, E & O and Adaptive/Maladaptive BF57 A+, C+, E+ & O+ Dimensions

HPI Correlation with BF57 Adaptive		HPI Correlation with BF57 Maladaptive		Steiger's Z transform, p	Hypothesis Supported
HPI A vs BF57 A+ Ada	0.47	HPI A vs BF57 A+ Mal	0.16	Z_h=4.24 p<0.001	Supported
HPI C vs BF57 C+ Ada	0.42	HPI C vs BF57 C+ Mal	0.39	Z_h=0.41, p=0.685	Not Supported
HPI E Ambition vs BF57 E+ Ada	0.48	HPI E Ambition vs BF57 E+ Mal	0.38	Z_h=1.62, p=0.105	Partially Supported
HPI E Sociability vs BF57 E+ Ada	0.62	HPI E Sociability vs BF57 E+ Mal	0.52	Z_h=1.83, p=0.068	Partially Supported
HPI O vs BF57 O+ Ada	0.34	HPI O vs BF57 O+ Mal	0.33	Z_h=0.16, p=0.88	Not Supported

Note: N = 154 and all comparisons were statistically significant (p<0.05) in the direction predicted.

Both Table 5-7 and Table 5-8 provide evidence that there are many occasions where the version of a scale which includes maladaptive aspects shows a quite different correlation to that found when its more adaptive measure is used. For example:

5.3.2.1 Adjustment

The maladaptive measure of Direct (A- Mal) was negatively correlated (r = -0.28) whereas the adaptive measure had almost no relation (r = -0.05) (Z_h = 3.27, p = 0.001). In a similar vein, the maladaptive measure of Introverted (E- Mal) showed a stronger inverse relation to Adjustment (r = -0.20 cf. r = -0.36) than the adaptive measure (Z_h = 3.04, p = 0.002). Adjustment also had a significantly greater correlation with the adaptive measure of Extraversion (E+ Ada) (r = 0.22 cf. r = 0.01, Z_h = 3.04, p = 0.002).

5.3.2.2 Ambition

The adaptive measure of being direct (A- Ada) was significantly and highly correlated with Ambition (r = 0.41) whereas the correlation dropped to 0.13 (Z_h = 4.11, p < 0.001) with the maladaptive measure (A- Mal). The maladaptive measure of being agreeable (A+ Mal) was significantly and highly correlated with Ambition (r = -0.44) whereas the correlation dropped to -0.16 (Z_h = 3.8, p < 0.001) with the adaptive measure (A+ Adal). Ambition was also significantly negatively correlated with the maladaptive measure of being Conscientious (C+ Mal) (r = -0.22) whilst there was a non-significant positive relation (r = 0.10) with the adaptive measure (Z_h = 3.9, p < 0.001). Ambition also had a significantly greater correlation with the adaptive measure of Openness (O+ Ada) (r = 0.33 cf. r = 0.16, Z_h = 2.56, p = 0.01).

5.3.2.3 Sociability

Sociability was significantly negatively correlated with the maladaptive measure of being Conscientious (C+ Mal) (r = -0.29) whilst a smaller correlation (r = -0.15) was found with the adaptive measure (Z_h = 1.74, p = 0.081). This suggests adaptive levels of Conscientiousness have little relationship with Sociability. However, overplayed Conscientiousness, such as being goal obsessed and/or engaging in too much detailed planning, is associated with much lower levels of Sociability.

5.3.2.4 Interpersonal Sensitivity

The adaptive measure of being Agreeable (A+ Ada) is significantly and highly correlated with Interpersonal Sensitivity (r = 0.47) whilst the maladaptive measure (A+ Mal) had a significantly smaller correlation (r = 0.16, Z_h = 4.24, p < 0.001). The adaptive measure of Extraverted is also much more strongly related to Interpersonal Sensitivity (r = 0.43 cf. 0.16; Z_h = 4.1, p < 0.001) than its maladaptive measure. For Introversion, the maladaptive measure is significantly more strongly related to Interpersonal Sensitivity (r = -0.31 cf. r = -0.45, Z_h = 2.78, p = 0.005).

5.3.2.5 Prudence

Another notable difference between a measure and its maladaptive version concerns the relationship between Prudence and being Flexible (C- Ada and C- Mal) (r = -0.52 cf. -0.33; Z_h = -2.72, p = 0.006). The maladaptive measure of being direct (A- Ada) is also more highly negatively correlated with Prudence than the adaptive

measure (r = -0.19 cf. r = -0.32, Z_h = 1.89, p = 0.059). This is also the case for the maladaptive measure of Extraversion (r = -0.05 cf. r = -0.21, Z_h = 2.31, p = 0.02).

5.3.2.6 Inquisitiveness

Inquisitiveness was significantly correlated with the adaptive measure of being Direct (r = 0.25) and its correlation with the maladaptive measure was significantly smaller (Z_h = 2.27, p = 0.023) with r = 0.09.

5.3.3 Divergent Adaptive / Maladaptive Validity with the HPI

Evidence was found that for the 56-hypothesized point to point *a priori* BF57 dimension to HPI trait correlations (detailed in Table 5-7: Raw Correlations BF57 Eighteen Scales with HPI), the adaptive BF57 scales correlated more highly with the HPI than the maladaptive scales on 42 occasions. The exact probability of at least this number of differences can be calculated from the binomial distribution and is equal to p = 0.00011722. This offers evidence to suggest the BF57 adaptive scales do correlate more highly with the HPI traits than the maladaptive measures.

5.3.4 Convergent Validity with the TDA

Internal consistency based on the one hundred item Trait Descriptive Adjectives sample of 420 people were; for Agreeableness (α = 0.88), Extraversion (α = 0.91), Openness (α = 0.83), Conscientiousness (α = 0.90) and Neuroticism (α = 0.88).

Table 5-9: Big Five Correlations between the BF57 and the TDA

	BF57 O	BF57 C	BF57 E	BF57 A	BF57 N
O TDA Adjectives	.59**	-.10*	.16**	-.11*	-.12*
C TDA Adjectives	-.19**	.61**	-.11*	-.03	-.23**
E TDA Adjectives	.28**	-.14**	.82**	-.19**	-.29**
A TDA Adjectives	.06	-.01	.21**	.42**	-.20**
N TDA Adjectives	-.15**	.04	-.15**	-.01	.67**

*Note: N = 420; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

Table 5-10: Concurrent Validity Coefficients (corrected for measurement reliability) between the BF57 and the TDA

		BF57 O	BF57 C	BF57 E	BF57 A	BF57 N
		α = 0.85	α = 0.79	α = 0.88	α = 0.80	α = 0.81
O TDA Adjectives	α = 0.83	0.70	-0.12	0.19	-0.13	-0.15
C TDA Adjectives	α = 0.90	-0.22	0.72	-0.12	-0.04	-0.27
E TDA Adjectives	α = 0.91	0.32	-0.17	0.92	-0.22	-0.34
A TDA Adjectives	α = 0.88	0.07	-0.01	0.24	0.50	-0.24
N TDA Adjectives	α = 0.88	-0.17	0.05	-0.17	-0.01	0.79

Note: N = 420.

Table 5-11: Raw Correlations BF57 Eighteen Scales with TDA

	TDA O	TDA C	TDA E	TDA A	TDA N
O+ Adaptive	.56**	-.14**	.22**	-.01	-.13**
O+ Maladaptive	.36**	-.28**	.11*	-.13**	.04
O- Adaptive	-.58**	.12*	-.35**	-.18**	.20**
O- Maladaptive	-.51**	.06	-.31**	-.19**	.23**
C+ Adaptive	-.02	.59**	-.09	.01	.04
C+ Maladaptive	-.19**	.32**	-.29**	-.14**	.28**
C- Adaptive	.15**	-.41**	.07	.00	-.01
C- Maladaptive	-.04	-.62**	.01	-.09	.17**
E+ Adaptive	.25**	-.02	.76**	.31**	-.17**
E+ Maladaptive	.14**	-.14**	.62**	.02	.00
E- Adaptive	-.06	.12*	-.75**	-.17**	.17**
E- Maladaptive	-.15**	.08	-.70**	-.23**	.22**
A+ Adaptive	.01	.03	.01	.49**	.03
A+ Maladaptive	-.13**	-.11*	-.26**	.23**	.18**
A- Adaptive	.14**	.09	.27**	-.25**	.03
A- Maladaptive	.05	-.09	.10*	-.41**	.20**
N+ Maladaptive	-.09	-.22**	-.32**	-.18**	.67**
N- Adaptive	.12*	.21**	.20**	.18**	-.54**

*Note: Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; N = 420; * p<0.05 ** p<0.01*

Table 5-9, Table 5-10 and Table 5-11 all provide strong evidence the BF57 five dimensions have convergent validity with the TDA. The correlation coefficients on the diagonal in Table 5-9 are all 0.5 or over.

The hypothesised greater correlations of the A+ Ada, C+ Ada, E+ Ada and O+ Ada scales with than TDA A, C, E and O scales, compared the A+ Mal, C+ Mal, E+ Mal and O+ Mal scales was tested. As with the HPI and IPIP-NEO hypothesis tests, Steiger's (1980) Z test was used to assess the significance of these differences. The results from this procedure are shown in Table 5-12. All hypotheses are supported.

Table 5-12: Correlations between TDA Big Five dimensions A, C, E & O and adaptive/maladaptive BF57 A+, C+, E+ & O+ dimensions

TDA Correlation with BF57 Adaptive		TDA Correlation with BF57 Maladaptive		Steiger's Z transform, p	Hypothesis Accepted?
TDA A vs BF57 A+ Ada	0.49	TDA A vs BF57 A+ Mal	0.23	Z_h=6.03 p<0.001	Supported
TDA C vs BF57 C+ Ada	0.59	TDA C vs BF57 C+ Mal	0.32	Z_h=6.36 p<0.001	Supported
TDA E vs BF57 E+ Ada	0.76	TDA E vs BF57 E+ Mal	0.62	Z_h=5.08, p<0.001	Supported
TDA O vs BF57 O+ Ada	0.56	TDA O vs BF57 O+ Mal	0.36	Z_h=5.59, p<0.001	Supported

Note: N = 420 and all comparisons were statistically significant (p<0.05) in the direction predicted.

5.3.5 Locating the BF57 Scales in the Periodic Table

5.3.5.1 EFA and Parallel Analysis on TDA

In the Parallel Analysis conducted here (using SPSS version 23), 1,000 data sets were randomly produced. From the analysis eight factors from the Principal Component Analysis were found to have eigenvalues greater than those produced from the simulated data at the 95th percentile. Data from the first nine roots are shown in the Table 5-13. Based on the work of Goldberg (1992), five factors had been expected in the data. It can be seen that there is a case for five factors with the raw data eigenvalue dropping to 2.591 for the sixth component, which is close to the 95th percentile of 2.12. Woods and Anderson (2016) undertook a similar factor analysis on TDA data and found it unnecessary to undertake a parallel analysis,

instead preferring to extract five factors deductively based on theory and checking to see how many of the 100 trait markers had their strongest loading on the expected factor. Woods and Anderson (2016) reported 87 and 93 out of 100 in two separate samples met this criteria, with 13 and 7 not meeting the criteria. For the TDA data in this research, the figure compared favourably at 94 out of 100 meeting this criteria. Of the 13 and 7 markers that did not load on the expected factor highest, they still loaded on the intended factor with the second highest loading 8 and 6 times respectively, leaving 5 and 1 trait adjectives as complete misses. The comparable figure for the TDA data's 6 initial misses was 4 loadings on the expected factor as the second highest, leaving just 2 complete misses. Firstly, the "Unsophisticated" adjective loaded -0.20 onto its intended factor of Openness, yet loaded -0.24 onto Extraversion and -0.23 onto Conscientiousness. Secondly, the "Shallow" adjective loaded 0.27 onto its intended factor of Neuroticism, yet loaded -0.29 onto Conscientiousness and -0.30 onto Agreeableness.

As a further check of the integrity of the TDA data, Table 5-14 shows the regression-scored factors from the TDA correlated with the raw scores for the Big Five dimensions from the TDA, after applying unit weighting to each adjective and assigning it to its intended factor as defined by Goldberg (1992). The correlations ranged between 0.93 and 0.97. The BF57 Big Five dimensions were also correlated with the regression based TDA factors as shown in Table 5-15. Between the two questionnaires, Openness correlated 0.66, Conscientiousness 0.66, Extraversion 0.81, Agreeableness 0.55 and Neuroticism 0.61.

Given the medium to high correlations in Table 5-14 and Table 5-15, combined with only 6 traits not loading highest on their intended factor, the five factors extracted from the TDA data can be considered to be a reasonable approximation to the lexical Big Five and suitable for applying Woods and Anderson (2016) periodic table methodology.

Table 5-13: Results of Parallel Analysis on TDA data

Root	Raw Data	Means	95th Percentile
1	14.696	2.74	2.95
2	8.498	2.53	2.67
3	6.814	2.38	2.50
4	5.345	2.24	2.34
5	4.418	2.13	2.22
6	2.591	2.03	2.12
7	2.335	1.93	2.02
8	1.964	1.84	1.92
9	1.796	1.76	1.83

Note: N = 420, Ndata sets = 1,000, variables =100.

Table 5-14: Big Five Correlations between TDA Adjective Scales and TDA Five Factors based on regression

	O TDA REGR factor score	C TDA REGR factor score	E TDA REGR factor score	A TDA REGR factor score	N TDA REGR factor score
O TDA Adjectives	.93**	.16**	.15**	.14**	.02
C TDA Adjectives	.06	.97**	.02	.13**	-.10*
E TDA Adjectives	.13**	-.04	.95**	.20**	-.11*
A TDA Adjectives	.11*	.18**	.16**	.93**	-.17**
N TDA Adjectives	-.02	-.09	-.19**	-.11*	.95**

*Note: N = 420; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

Table 5-15: Big Five Correlations between TDA Five Factors based on regression and the BF57

	O TDA REGR factor score	C TDA REGR factor score	E TDA REGR factor score	A TDA REGR factor score	N TDA REGR factor score
BF57 O	.66**	-.25**	.18**	-0.02	-.13**
BF57 C	-.18**	.66**	-0.09	-0.06	0.07
BF57 E	0.08	-.15**	.81**	.13**	-0.01
BF57 A	-.13**	-.11*	-.32**	.55**	-0.04
BF57 N	-0.07	-.19**	-.26**	0.01	.61**

*Note: N = 420; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

5.3.5.2 Periodic Table Mapping

Woods and Anderson's (2016) procedure was then followed in this research and the BF57 eighteen scales have been located in the periodic table and the results displayed in Table 5-16.

Table 5-16: Periodic Table Analysis derived from TDA Five Factors based on regression correlation with the Eighteen BF57 scales

	O REGR factor score	C REGR factor score	E REGR factor score	A REGR factor score	N REGR factor score	Top Aspect	Second Aspect	Ratio	Vector
O+ Adaptive	.63**	-.19**	.14**	-.09	-.12*	O+	C-	3.35	.65
O+ Maladaptive	.46**	-.29**	.06	-.15**	.04	O+	C-	1.58	.55
O- Adaptive	-.60**	.21**	-.24**	-.10*	.17**	O-	E-	2.53	.65
O- Maladaptive	-.53**	.13**	-.19**	-.11*	.20**	O-	N+	2.66	.57
C+ Adaptive	-.11*	.62**	-.04	-.05	.07	C+	Pure	5.73	.63
C+ Maladaptive	-.21**	.37**	-.24**	-.07	.27**	C+	N+	1.39	.46
C- Adaptive	.23**	-.44**	.02	.03	-.05	C-	O+	1.92	.50
C- Maladaptive	.04	-.62**	-.01	.05	.16**	C-	Pure	4.02	.64
E+ Adaptive	.14**	-.08	.72**	.22**	-.02	E+	A+	3.20	.75
E+ Maladaptive	.08	-.14**	.65**	-.05	.13**	E+	Pure	4.59	.67
E- Adaptive	.05	.16**	-.75**	-.11*	.05	E-	Pure	4.85	.77
E- Maladaptive	-.04	.14**	-.66**	-.17**	.11*	E-	Pure	3.91	.68
A+ Adaptive	-.05	-.05	-.10*	.58**	.05	A+	Pure	6.03	.59
A+ Maladaptive	-.13*	-.15**	-.32**	.39**	.16**	A+	E-	1.20	.50
A- Adaptive	.15**	.17**	.37**	-.40**	.09	A-	E+	1.08	.54
A- Maladaptive	.10*	-.00	.22**	-.46**	.22**	A-	N+	2.05	.51
N+ Maladaptive	-.05	-.17**	-.30**	.02	.61**	N+	E-	2.07	.68
N- Adaptive	.10*	.18**	.16**	.01	-.49**	N-	C+	2.78	.52

*Note: N = 420; Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

The BF57 scales have been correlated with the TDA factors, which are considered to be representative of the lexical Big Five as shown in Table 5-16. Industry standard codes have been used to demonstrate the allocation of the BF57 scales to the AB5C circumplex framework. The vector length has also been reported in the final right-hand column.

There are 45 possible “facet sectors” in the periodic table, covering all possible combinations of a top and second aspect. Woods and Anderson (2016, p. 598) analysed the 45 facet sectors across 10 well researched personality inventories and found 4 of the sectors not represented in any of the facets of the 10 models. The 10 models included the HPI, as used in this research, as well as the OPQ (Bartram,

Brown, Fleck, Inceoglu & Ward, 2006), the 16PF5 (Conn & Rieke, 1994) and NEO PI-R (Costa & McCrae, 1992a). Woods and Anderson (2016) also created what they termed an “abundance” metric to indicate which of the remaining facet sectors were strongly covered by the 273 scales in the 10 instruments, versus those sparsely covered. This scale went from 0 to 3.96, which was for the facet sector ES+A+/ES-A- that he termed “Calmness”. He found 5 facet sectors contained 91 of the 273 scales and 3 of the 5 are covered by the BF57 scales. Namely:

i. E+A+/E-A- (abundance metric 2.14) covering E+ Adaptive
ii. ES+E+/ES-E- (abundance metric 2.47) covering N+ Adaptive
iii. O+C-/O-C+ (abundance metric 2.97) covering O+ Adaptive

The facets sectors often covered in other instruments, such as E+O+/E-O- (abundance metric 3.79) and ES+A+/ES-A- (abundance metric 3.96) are not covered in the BF57.

However, two of the facet sectors that are less commonly covered in other instruments were covered in the BF57, such as:

i. A+E-/A-E+ (abundance metric 0.33) covering A+ Maladaptive
ii. A+A+/A-A- (abundance metric 0.33) covering A+ Adaptive

Interestingly, one of the facet sectors with zero coverage in the other 10 instruments is covered by the BF57, namely C+ES-/C-ES+ (abundance metric 0) covering C+ Maladaptive.

5.3.6 Multitrait-Multimethod using BF57, TDA, HPI & IPIP-NEO

Table 5-17: Multitrait-Multimethod for the Big Five

	O BF57	C BF57	E BF57	A BF57	N BF57	O TDA	C TDA	E TDA	A TDA	N TDA
O BF57	0.85									
C BF57	-.51**	0.79								
E BF57	.31**	-.32**	0.88							
A BF57	-0.17	-0.04	-.36**	0.80						
N BF57	-.28**	0.09	-.22*	.27**	0.81					
O TDA	.59**	-.20*	0.07	-0.11	-0.12	0.83				
C TDA	-.35**	.71**	-.32**	0.06	-0.16	0.12	0.90			
E TDA	.34**	-.38**	.86**	-.34**	-.29**	.27**	-.22*	0.91		
A TDA	-0.02	0.05	0.00	.53**	-0.02	0.15	.36**	0.07	0.88	
N TDA	-.19*	0.16	-0.07	0.06	.74**	-0.01	-0.13	-0.16	-0.11	0.88

*Note: N = 105; * p<0.05 ** p<0.01*

Table 5-17: Multitrait-Multimethod for the Big Five continued

	O BF57	C BF57	E BF57	A BF57	N BF57	O TDA	C TDA	E TDA	A TDA	N TDA
O HPI	.38**	-0.17	0.15	-.26**	-.23*	.54**	0.06	.36**	-0.04	-0.15
C HPI	-.49**	.61**	-.27**	.32**	0.04	-.21*	.62**	-.34**	.40**	-0.09
E HPI	.31**	-.35**	.73**	-.31**	-0.16	.23*	-.24*	.76**	0.04	-0.06
A HPI	.22*	-.23*	.39**	.28**	-.24*	0.09	0.00	.46**	.46**	-.30**
N low HPI	0.01	-0.09	.21*	0.12	-.59**	-0.06	0.08	.22*	.22*	-.63**
O NEO	.67**	-.44**	.25*	-0.03	-.24*	.67**	-0.16	.42**	0.13	-0.14
C NEO	-.31**	.71**	-.19*	0.03	-.23*	0.06	.85**	-0.16	.28**	-0.14
E NEO	.30**	-.25*	.79**	-.34**	-.36**	.25**	-0.08	.84**	0.14	-0.16
A NEO	-0.14	0.02	-0.11	.58**	-0.12	-0.07	.27**	-0.11	.67**	-.26**
N NEO	-.25**	.30**	-.39**	0.14	.76**	-0.14	-0.03	-.47**	-0.09	.68**

*Note: N = 105; * p<0.05 ** p<0.01*

Table 5-17: Multitrait-Multimethod for the Big Five continued

	O HPI	C HPI	E HPI	A HPI	N HPI	O NEO	C NEO	E NEO	A NEO	N NEO
O HPI	0.80									
C HPI	-.28**	0.71								
E HPI	.41**	-.32**	0.83							
A HPI	0.04	0.14	.31**	0.57						
N low HPI	0.01	.29**	0.12	.55**	0.82					
O NEO	.65**	-.40**	.41**	.24*	0.02	0.83				
C NEO	-0.01	.62**	-0.17	0.06	0.15	-.22*	0.90			
E NEO	.32**	-0.16	.74**	.49**	.28**	.39**	0.03	0.89		
A NEO	-0.09	.43**	-0.13	.45**	.38**	0.11	.29**	0.00	0.87	
N NEO	-.23*	0.08	-.36**	-.48**	-.69**	-.26**	-0.14	-.53**	-.21*	0.90

*Note: N = 105; * p<0.05 ** p<0.01*

The HPI “Sociable” scale was taken as the best marker for Extraversion in this analysis. In the earlier correlational analysis, the “Ambition” scale correlations with not just E, but also A and N in Table 5-5 were statistically significant, and on this basis “Ambition” was not used in Table 5-16.

The BF57 Big Five correlations with the TDA Big Five were all above the BPS standards for concurrent validity, and if adjusted, also above the higher COTAN European standards. The BF57 Big Five correlations with the IPIP-NEO Big Five were all above both the BPS and COTAN standards.

However, the BF57 Big Five correlations with the HPI Big Five dipped below the COTAN standard for Openness with a raw correlation of 0.38, rising to 0.46 when adjusted (meeting the BPS standard). The BF57 Agreeableness correlation with the HPI’s Agreeableness had the lowest raw correlation of 0.28, rising to 0.41 when adjusted and missed both the BPS and COTAN European standards. It is possible this result is an anomaly based on a relatively small sample size (N = 105) as the HPI also has relatively low correlations for Agreeableness with the IPIP-NEO (0.45) and TDA (0.46). Furthermore, the BF57 Agreeableness correlates 0.53 with the TDA and 0.58 with the IPIP-NEO.

5.3.7 Convergent and Divergent Validity with the HDS

There has been some debate about the relationship of the dark side (Hogan & Hogan, 1997) scales (Excitable, Sceptical, Cautious, Reserved, Leisurely, Bold, Mischievous, Colourful, Imaginative, Diligent and Dutiful) to the Big-Five. To render any analysis here more clear, data from the 11 dimensions were factor analysed. Despite the relatively small sample size, sampling adequacy for the analysis was high; KMO = 0.744 (Norman & Streiner, 1994). Factor analysis (principal components) in SPSS (version 23) and parallel analysis (see Table 5-18) suggested two factors with eigenvalues greater than those produced from the simulated data at the 95th percentile – which accounted for 50.2% of the variance. As Hogan and Hogan’s (1997) own analysis of the scales has suggested three factors, the factor structure for a three-factor model are shown below (see Table 5-19) for comparison purposes. The three-factor model has been used in the subsequent analysis.

Table 5-18: Results of Parallel Analysis of Hogan Developmental Survey

Root	Raw Data	Means	95th Percentile
1	3.502	1.476	1.631
2	2.330	1.337	1.413
3	1.171	1.232	1.311

Note: N = 138, Ndata sets = 100, variables = 11.

Table 5-19: Factor Analysis of Hogan Developmental Survey – Rotated Component Matrix

	Component		
	1	2	3
	Moving Against People	Moving Away from People	Moving Toward People
Excitable		0.84	
Skeptical		0.84	
Cautious	-0.59	0.42	
Reserved		0.66	
Leisurely		0.67	
Bold	0.78		
Mischievous	0.81		
Colourful	0.76		
Imaginative	0.79		
Diligent			0.79
Dutiful			0.74

Note: Varimax Rotation. Absolute loadings >0.40 shown. N = 138.

On the basis of the factor structure in Table 5-19 and the correlations in Table 5-20 and Table 5-22, the first factor can be considered as a measure of Extraversion and Openness blended with reversed Agreeableness and reversed Neuroticism. It has been labelled by Hogan and Hogan (1997) as “moving against”. This combination seems to largely accord with Digman’s (1997) Beta construct.

The second factor is a combination of Introversion (reversed Extraversion) and Neuroticism. It has been termed by Hogan and Hogan (1997) as “moving away” and to an extent accords with Digman’s Alpha construct, but with a lower element of Conscientiousness in it, as the factor correlated with r = 0.13.

Conscientiousness has the highest correlation with the third factor labelled “moving towards people” (Hogan & Hogan, 1997), with r = 0.44.

The HDS three factor scores extracted were correlated with their respective Big Five dimensions from the BF57 instrument in Table 5-21, as well as with the BF57's eighteen scales in Table 5-24.

Table 5-20: Raw Correlations of the five dimensions of BF57 with HDS 11 scales

	Moving Away from People					**Moving Against People**				**Moving Toward People**	
	Excitable	Skeptical	Cautious	Reserved	Leisurely	Bold	Mischievous	Colorful	Imaginative	Diligent	Dutiful
BF57 O	-.14	-.08	-.31**	-.05	-.11	.29**	.52**	.49**	.72**	-.22**	-.25**
BF57 C	.11	.14	.10	.12	.09	.02	-.25**	-.28**	-.17*	.60**	.16
BF57 E	-.30**	-.19*	-.56**	-.46**	-.24**	.30**	.48**	.73**	.32**	-.25**	-.17*
BF57 A	-.21*	-.20*	.41**	-.26**	.04	-.32**	-.38**	-.27**	-.19*	-.11	.32**
BF57 N	.52**	.39**	.42**	.02	.10	-.24**	-.32**	-.18*	-.17*	.00	.24**

*Note: N = 138; Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed)*

Table 5-21: Raw Correlations of the five dimensions of BF57 with HDS 3 factors

	Component		
	1	2	3
	Moving Against People	Moving Away from People	Moving Toward People
BF57 O	.58**	-.07	-.20*
BF57 C	-.10	.13	.44**
BF57 E	.53**	-.37**	-.18*
BF57 A	-.42**	-.23**	.15
BF57 N	-.32**	.33**	.04

*Note: N = 138; Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed)*

5.3.7.1 Maladaptive BF57 Scales to have Higher Correlations than HDS Scales than Adaptive BF57 Scales

Based on Table 5-22, evidence was examined based on the 9 pairs of adaptive/maladaptive BF57 scales differential correlation with the 11 HDS scales and this showed:

H16: Of the 45 pairs of "moving away" based correlations (5 HDS scales multiplied by the 9 BF57 pairs), 36 showed a higher correlation between the maladaptive BF57 scale and the HDS scale than the adaptive BF57 scale correlation with the same HDS scale. 9 had a higher correlation with the adaptive BF57 scale. The exact probability of at least this number of higher maladaptive correlations can be calculated from the binomial distribution and is equal to $p < 0.0005$. This offers evidence to suggest the BF57 maladaptive scales do correlate more highly with HDS "moving away" scales than the adaptive measures and the hypothesis is accepted.

H17: Of the 36 pairs of "moving against" based correlations (4 HDS scales multiplied by the 9 BF57 pairs), 5 showed a higher correlation between the maladaptive BF57 scale and the HDS scale than the adaptive BF57 scale correlation with the same HDS scale. 31 had a higher correlation with the

adaptive BF57 scale. The exact probability of at least this number of higher adaptive correlations can be calculated from the binomial distribution and is equal to p = 0.00015. This offers evidence to suggest the BF57 maladaptive scales do not correlate more highly with HDS “moving against” scales than the adaptive measures and the hypothesis is accepted. In fact, there is evidence the adaptive scales correlate more highly with the HDS “moving against” scales than the maladaptive measures.

H18: Of the 18 pairs of “moving toward” based correlations (2 HDS scales multiplied by the 9 BF57 pairs), 9 showed a higher correlation between the maladaptive BF57 scale and the HDS scale than the adaptive BF57 scale correlation with the same HDS scale. 9 pairs had a higher correlation with the adaptive BF57 scale. As this is fifty percent each way, there is no evidence of any difference between adaptive and maladaptive BF57 scale correlations with the HDS “moving toward” factor.

Table 5-22: Raw Correlations of BF57 with HDS 11 scales

	Moving Away from People					Moving Against People				Moving Toward People	
	Excitable	Skeptical	Cautious	Reserved	Leisurely	Bold	Mischievous	Colorful	Imaginative	Diligent	Dutiful
O+ Adaptive	-.11	-.07	-.24**	.01	-.07	.31**	.49**	.44**	.67**	-.15	-.26**
O+ Maladaptive	.02	.10	-.23**	.13	.07	.30**	.45**	.44**	.66**	-.14	-.19*
O- Adaptive	.27**	.21*	.33**	.20*	.25**	-.14	-.42**	-.41**	-.60**	.30**	.24**
O- Maladaptive	.14	.15	.29**	.14	.17*	-.26**	-.46**	-.41**	-.59**	.21*	.18*
C+ Adaptive	.06	.15	.08	.05	.15	.08	-.07	-.13	-.04	.56**	.10
C+ Maladaptive	.21*	.27**	.28**	.16	.17*	-.09	-.42**	-.33**	-.27**	.46**	.25**
C- Adaptive	-.13	-.09	-.09	-.04	.04	.04	.27**	.26**	.21*	-.45**	-.18*
C- Maladaptive	.03	.04	.08	-.15	-.01	-.10	.10	.22**	.06	-.47**	-.01
E+ Adaptive	-.29**	-.23**	-.48**	-.50**	-.22**	.28**	.44**	.67**	.33**	-.18*	-.08
E+ Maladaptive	-.12	.02	-.42**	-.18*	-.03	.28**	.49**	.67**	.37**	-.15	-.18*
E- Adaptive	.24**	.15	.54**	.42**	.25**	-.23**	-.38**	-.61**	-.19*	.26**	.15
E- Maladaptive	.40**	.31**	.50**	.52**	.34**	-.23**	-.35**	-.56**	-.22**	.26**	.16
A+ Adaptive	-.20*	-.18*	.27**	-.40**	.00	-.23**	-.19*	-.10	-.07	-.01	.25**
A+ Maladaptive	.00	.00	.53**	-.13	.23**	-.31**	-.40**	-.26**	-.19*	-.10	.41**
A- Adaptive	.14	.16	-.36**	.20*	.01	.36**	.38**	.27**	.24**	.18*	-.25**
A- Maladaptive	.33**	.31**	-.23**	.17*	.07	.16	.29**	.25**	.11	.07	-.17*
N+ Maladaptive	.52**	.43**	.46**	.06	.16	-.21*	-.32**	-.22*	-.14	.02	.25**
N- Adaptive	-.44**	-.28**	-.29**	.05	.00	.25**	.27**	.10	.19*	.04	-.20*

*Note: N = 138; Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed)*

Table 5-23: Correlations between HDS 3 factors and adaptive/maladaptive BF57 scales

HDS Correlation with BF57 Adaptive		HDS Correlation with BF57 Maladaptive		Steiger's Z transform, p	Hypothesis Accepted?
HDS Moving Against vs BF57 E+ Ada	0.50	HDS Moving Against vs BF57 E+ Mal	0.54	Z_h= -0.66, p=0.512	Partially Supported
HDS Moving Against vs BF57 O+ Ada	0.56	HDS Moving Against vs BF57 O+ Mal	0.55	Z_h= 0.17, p=0.864	Not Supported
HDS Moving Away vs BF57 E- Ada	0.34	HDS Moving Away vs BF57 E- Mal	0.49	Z_h= -2.87, p=0.004	Supported
HDS Moving Away vs BF57 A- Ada	0.19	HDS Moving Away vs BF57 A- Mal	0.34	Z_h= -2.07, p=0.038	Supported
HDS Moving Toward vs BF57 C+ Ada	0.41	HDS Moving Toward vs BF57 C+ Mal	0.39	Z_h= 0.26, p=0.799	Not Supported

Note: N = 138.

As can be seen in Table 5-23, two of the predictions are supported ($p<0.05$) and in one other case, although the correlation is not statistically significantly, the observed differences are in the predicted direction. For O+ Ada the hypothesis was not supported, nor was it for C+ Ada. It should be noted however that the reduced statistical power in this analysis means that in the case of the E+ Ada to E+ Mal comparison, the correlation would have needed to be equal to 0.62 to attain significance.

In a more detailed analysis, Pearson correlation coefficients were computed firstly, between the five summed dimension scores from the BF57 instrument and the eleven dimensions of the HDS and secondly, between each of the 18 scales from the BF57 and the eleven dimensions of the HDS. The correlations are shown in Table 5-20 and Table 5-22.

Table 5-24: Raw Correlations of BF57 with HDS 3 factors

	Component		
	1	2	3
	Moving Against People	Moving Away from People	Moving Toward People
O+ Adaptive	.56**	-.02	-.15
O+ Maladaptive	.55**	.14	-.13
O- Adaptive	-.43**	.25**	.26**
O- Maladaptive	-.49**	.15	.15
C+ Adaptive	.04	.13	.41**
C+ Maladaptive	-.26**	.22**	.39**
C- Adaptive	.16	-.05	-.34**
C- Maladaptive	-.02	-.02	-.31**
E+ Adaptive	.50**	-.39**	-.08
E+ Maladaptive	.54**	-.09	-.15
E- Adaptive	-.41**	.34**	.21*
E- Maladaptive	-.39**	.49**	.18*
A+ Adaptive	-.23**	-.26**	.18*
A+ Maladaptive	-.43**	-.01	.20*
A- Adaptive	.45**	.19*	-.04
A- Maladaptive	.28**	.30**	-.12
N+ Maladaptive	-.31**	.38**	.07
N- Adaptive	.29**	-.21*	.01

*Note: N = 138; Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

Table 5-25: Factor Analysis with 9 BF57 Maladaptive Scales and 11 HDS scales makes the case for the combined HDS and BF57 conforming to a five factor and helps interpret the HDS three factors in Big Five terms. Factor one is “Moving Against” made up of Openness and Extraversion (Digman’s Beta factor). Factor two is Neuroticism combined with Disagreeableness and underpins “Moving Away”. Being overly Agreeable (a ‘people pleaser’) is the third factor. The fourth factor is an Introversion factor linked to “Moving Away”. The fifth factor is Conscientiousness linked to “Moving Towards”.

Table 5-25: Factor Analysis with 9 BF57 Maladaptive Scales and 11 HDS scales

	Component				
	1	2	3	4	5
	Moving Against People	Moving Away from People (Neurotically)	Moving Toward People (Agreeably)	Moving Away from People (Introvertedly)	Moving Toward People (Conscientiously)
	Openness	Neuroticism	Agreeableness	Introversion (Reversed Extraversion)	Conscientiousness
O+ Maladaptive	.80				
O- Maladaptive	-.71				
C+ Maladaptive					.59
C- Maladaptive					-.73
E+ Maladaptive	.40			-.70	
E- Maladaptive				.69	
A+ Maladaptive			.84		
A- Maladaptive		.50	-.58		
N+ Maladaptive		.64			
Excitable		.84			
Skeptical		.84			
Cautious		.41	.57		
Reserved				.64	
Leisurely		.55			
Bold	.58				
Mischievous	.69		-.41		
Colorful	.57			-.63	
Imaginative	.87				
Diligent					.84
Dutiful			.67		

Note: N = 138; Absolute loadings >0.4 displayed.

5.3.8 Differential Adaptive / Maladaptive BF57 & HDS Validities

As with the previous analysis, the measure which includes maladaptive aspects exhibited, on a number of occasions, a quite different correlation to that observed when the more adaptive measure was used. These differences were particularly noted with the BF57 scales under Agreeableness and Conscientiousness across a range of the HDS scales (Excitable, Cautious, Reserved Leisurely and Mischievous). Below are the differences and the Steiger's (1980) Z-transformations, based on the validity data in Table 5-22 and the correlations detailed in Appendix VIII: BF57 Eighteen Scales Correlation Matrix.

5.3.8.1 Excitable

The adaptive measure of being agreeable (A+ Ada) was significantly negatively correlated with Excitable (r = -0.20) whereas with the maladaptive measure (A+ Mal) the correlation fell to zero (Z_h = -2.42, p = 0.015). Excitable was significantly correlated (r = -0.29) with the adaptive measure of Extraversion (E+ Ada) whereas the correlation with the maladaptive measure (E+ Mal) fell to -0.12 (Z_h = -2.36, p = 0.018). The adaptive measure of Introversion (E- Ada) exhibited a significantly smaller correlation with Excitable than the maladaptive measure (r = 0.24 cf. r = 0.40, Z_h = -2.92, p = 0.003).

5.3.8.2 Skeptical

For Skeptical the maladaptive measure of Direct (A- Mal) had a significantly greater correlation than the adaptive measure (r = 0.16 cf. r = 0.31, Z_h = -2.10, p = 0.04). This was also true of the correlation with the maladaptive measure of Introversion (E- Mal) (r = 0.15 cf. r = 0.31, Z_h = -2.83, p = 0.004). Furthermore, the adaptive measure of Extraversion (E+ Ada) was more negatively correlated with Skeptical than the maladaptive (E+ Mal) (r = -0.23 cf. r = 0.02, Z_h = -3.42, p < 0.001).

5.3.8.3 Cautious

The maladaptive measure of Agreeable (A+ Mal) produced a significantly higher correlation than the adaptive measure (r = 0.27 cf. r = 0.53, Z_h = -3.51, p < 0.001). This was also true for the maladaptive measure of being conscientious (C+ Mal) (r = 0.08 cf. r = 0.28, Z_h = -2.34, p = 0.019).

5.3.8.4 Reserved

The correlation with Reserved was significantly lower for the maladaptive measure of Agreeableness (A+ Mal) ($r = -0.40$ cf. $r = -0.13$, $Z_h = -3.41$, $p < 0.001$). This was also the case for the correlation with the maladaptive measure of Extraversion (E+ Mal) ($r = -0.50$ cf. $r = -0.18$, $Z_h = -4.71$, $p < 0.001$).

5.3.8.5 Leisurely / Stubborn / Obstinate

The maladaptive measure of Agreeableness (A+ Mal) had a significantly greater correlation with Leisurely than the adaptive measure ($r = 0.00$ cf. $r = 0.23$, $Z_h = -2.79$, $p = 0.005$) whilst for Extraversion the maladaptive measure had a significantly smaller correlation with Leisurely ($r = -0.22$ cf. $r = -0.03$, $Z_h = -2.6$, $p = 0.009$).

5.3.8.6 Bold

The correlation between being Direct (A- Ada) in the BF57 and Bold in the HDS was lower for the maladaptive measure ($r = 0.36$ cf. $r = 0.16$, $Z_h = 2.81$, $p = 0.005$).

5.3.8.7 Mischievous

The maladaptive measure of being Agreeable (A+ Mal) had a greater correlation with Mischievous than the adaptive measure ($r = -0.19$ cf. -0.40, $Z_h = 3.11$, $p = 0.002$). This was also the case for the maladaptive measure of being Conscientious ($r = -0.07$ cf. $r = -0.42$, $Z_h = 4.2$, $p < 0.001$).

5.3.8.8 Colourful

The maladaptive measure of being conscientious (C+ Mal) produced higher correlations with being Colourful ($r = -0.13$ cf. $r = -0.33$, $Z_h = 2.37$, $p = 0.018$).

5.3.8.9 Imaginative

The maladaptive measure of being Conscientious (C+ Mal) produced higher correlations with being Imaginative ($r = -0.04$ cf. $r = -0.27$, $Z_h = 2.67$, $p = 0.007$).

5.3.8.10 Dutiful

The maladaptive measure of being Agreeable (A+ Mal) produced higher correlations with being Dutiful ($r = 0.25$ cf. $r = 0.41$, $Z_h = -2.07$, $p = 0.038$).

5.4 Study Two Discussion

Table 5-26: Summary of Study Two Hypotheses

Hypothesis	Outcome
H3: BF57 Big Five dimensions converge with TDA Big Five	All Supported
H4: BF57 Big Five dimensions converge with IPIP-NEO	All Supported
H5: BF57 Big Five dimensions converge with HPI	All Supported
H6: Multitrait-Multimethod convergent and divergent validity with BF57, TDA, IPIP-NEO and HPI	All Supported
H7: TDA / IPIP-NEO / HPI correlation greater with BF57 A+ Ada than A+ Mal	All Supported
H8: TDA / IPIP-NEO / HPI correlation greater with BF57 C+ Ada than C+ Mal	TDA Supported IPIP-NEO Supported HPI not Supported
H9: TDA / IPIP-NEO / HPI correlation greater with BF57 E+ Ada than E+ Mal	TDA Supported IPIP-NEO Supported HPI Partially Supported
H10: TDA / IPIP-NEO / HPI correlation greater with BF57 O+ Ada than O+ Mal	TDA Supported IPIP-NEO Supported HPI not Supported
H11: HDS Moving Against correlation greater with BF57 E+ Mal than E+ Ada	Not Supported
H12: HDS Moving Against correlation greater with BF57 O+ Mal than O+ Ada	Not Supported
H13: HDS Moving Away correlation greater with BF57 E- Mal than E- Ada	Supported
H14: HDS Moving Away correlation greater with BF57 A+ Mal than A+ Ada	Supported
H15: HDS Moving Toward correlation greater with BF57 C+ Mal than C+ Ada	Not Supported
H16: of the 45 pairs of “moving away” correlations, more have higher correlation with maladaptive BF57 than adaptive BF57	Supported
H17: of the 36 pairs of “moving against” correlations more have higher correlation with maladaptive BF57 than the adaptive BF57	Not Supported
H18: of the 18 pairs of “moving toward” correlations more higher correlation with maladaptive BF57 than adaptive BF57	Not Supported

5.4.1 The BF57's Big Five Credentials

The results offer good evidence that the BF57 is best described as a five-factor model consistent with Big Five theory. At the level of the five dimensions in the IPIP-NEO, all five correlate at least 0.59 (corrected) or more with the BF57 five dimensions, exceeding the BPS 0.45 standard and the COTAN European 0.55 standard. The HPI equivalent dimensions of C, E, A and N also exceed this standard, with O just dipping below at 0.44 (corrected). Similarly, when the TDA has five dimensions created from the adjectives, all five correlate above the BPS standard with the BF57 and the lowest of the five is Agreeableness at 0.50 (corrected). The Multitrait-Multimethod analysis with the same three instruments produces a similarly encouraging picture for the IPIP-NEO and TDA. However, the BF57 correlations with the HPI dip to 0.38 (uncorrected) for Openness and 0.28 (uncorrected) for Agreeableness. An inspection of the HPI correlations with the IPIP-NEO show the Agreeableness correlation it is less than expected at 0.45, and for the TDA is also low at 0.46.

5.4.2 New Element in the Periodic Table

An inspection of the BF57 three items that measure C+ Maladaptive was undertaken. Applying the approach advocated by Woods and Anderson (2016) places this scale in the C+ES-/C-ES+ blended factor cell of the periodic table (a previously under researched area according to Woods and Anderson (2016)). The items do appear to have good face validity to support this placing. The items are "My focus on my commitments can make it difficult for me to make spontaneous decisions", "I can stick too rigidly to a plan" and "I find it difficult to work with those who like to work last-minute". It would appear the Conscientiousness based desire for order is blended in all three of these items with an anxiety that could be linked to Neuroticism.

5.4.3 TDA Factor Analysis

A principal components analysis was undertaken on the TDA data and five factors extracted and rotated to a varimax solution. The TDA data is shown in Appendix X – Expected and Actual Adjective Level Factor Loadings for the TDA.

It is interesting to explore the notion that Neuroticism may be one root source of the maladaptive scales in the BF57. It is notable in Table 5-16, that three maladaptive scales (C+, A-, O-) have a second highest loading on N+ and the remaining five maladaptive scales (E+, E-, C-, A+, O+) do not have a second highest loading on N+. This suggests Neuroticism does have a relationship with maladaptive scales, but it is not consistently present and this would be a fruitful area for further research.

5.4.4 Multitrait-Multimethod

At the level of the five dimensions, the BF57 Openness correlated -0.51 with BF57 Conscientiousness in the Multitrait-Multimethod analysis. This is higher than the equivalent for the TDA at 0.12, and -0.28 for the HPI and for the IPIP-NEO it is -0.22. Given the sample size is only 105, cross checking with the larger N = 2,506 BF57 sample, we find BF57 Openness correlates at a lower level of -0.34 with BF57 Conscientiousness. This may merit more research as other authors (Bäckström et al., 2014, p. 627) have shown when measuring reversed Openness, it can correlate more highly with Conscientiousness than positive Openness.

5.4.5 Using the BF57 to Analyse Other Personality Instruments

One possible strength of the BF57 is that it may function as an instrument for dissecting and assessing the construct validity of existing instruments in a way that other instruments may not be able to, and may well compliment the TDA periodic table analysis. This idea is supported by the greater semantic coverage of the constituents of personality the BF57 brings, as shown by the periodic table analysis in Table 5-16.

Just as we can use the BF57 to explore what other instruments measure at both polarities, adaptively and maladaptively, we can also use the correlations between them to inform us about what the BF57 is measuring. Each can cast light on each other.

5.4.6 Hogan Learning Approach

This scale in the HPI appears on first inspection not to be assessing aspects of personality, but rather attitudes to learning and approach to schooling.

5.4.7 H11, H12, H15, H17 and H18 not supported

Counter to a number of the hypotheses, there is evidence that the HDS “Moving Against” scales are more correlated with adaptive rather than maladaptive BF57 scales. In addition, the H18 hypothesis regarding “Moving Toward” was not supported. There are a number of possible reasons that merit exploring to potentially explain these results. The results do draw into question how maladaptive a number of the HDS scales may be. It may also be possible that the BF57 adaptive scales may inadvertently contain a maladaptive element or that the BF57 maladaptive scales are significantly less maladaptive than the HDS scales. Study Three explores some of these possible reasons through examining the correlations between the BF57 adaptive and maladaptive scales, and performance at work. It also examines the correlation between the HDS scales and performance at work.

5.4.8 Conclusion

This study has fully assessed the convergent and divergent validity of the BF57. The hypotheses tests have found good evidence to confirm the BF57 as a Big Five model. Further depth of analysis provided by an application of the periodic table methodology advocated by Woods and Anderson’s (2016) further enhances the BF57’s Big Five credentials. All eighteen BF57 scales have been located in the periodic table within the intended area of the Big Five.

Finally, the evidence is clear that it is possible to measure the Big Five factors at both ends of the polarities whilst simultaneously measuring Openness, Conscientiousness, Extraversion and Agreeableness both adaptively and maladaptively.

6 STUDY THREE: THE CRITERION VALIDITY OF THE BF57

6.1 Introduction

The third study answered three of the research questions and tested criterion-validity hypotheses. Observer 360-feedback was collected assessing individuals' performance at work. This included measures of the individuals':

i. 'Great Eight' competencies (N = 254)
ii. 'Professional Competencies' if they worked in a professional environment (N = 254)
iii. 'Leadership Competencies' if they had staff (N = 73)

Analysis of the correlations were undertaken between the:

i. BF57 and the Great Eight
ii. BF57 maladaptive and HDS maladaptive scales and the Great Eight
iii. BF57 and the Professional Competencies
iv. BF57 and the Leadership Competencies

6.1.1 Research Questions Addressed

This study sought to answer the following three research questions:

RQ6: How well does the BF57 comply with *a priori* hypothesized criterion validity relationships with the Great Eight competency model?

RQ7: Is there a differential pattern of criterion validities between the BF57 adaptive and maladaptive scales and if so, what can be learnt from this?

RQ8: Compared to the BF57 five-dimensional bandwidth approach, can the higher fidelity BF57 eighteen scales explain more of the variance in the personality criterion relationship?

6.1.2 BF57 and Great Eight Hypotheses

6.1.2.1 11 Point to Point *a priori* Hypotheses

The criterion-related validity of the BF57 has been explored by testing the *a priori* derived hypotheses on the relationship between the BF57 dimensions and scales with the Great Eight Competencies (Kurz & Bartram, 2002; Kurz, 2003; Bartram, 2005) as the measure of performance using correlational analyses. Correlational analysis was also used to identity which scales accounted for more of the variance when correlating with a number of varying indicators of performance at work. Based on the correlations between personality predictors and behavioural competency criterion found by Bartram (2005) and Saville et al. (2009), the following hypotheses for the BF57 correlations with the Great Eight in this research have been made.

H19: "Analysing Situations" will correlate positively with at least one of the positive Openness scales, or negatively with at least one of the negative Openness scales

H20: "Creating Concepts" will correlate positively with at least one of the positive Openness scales, or negatively with at least one of the negative Openness scales

H21: "Relating to People" will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales

H22: "Controlling Resources" will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales

H23: "Respecting People" will correlate positively with at least one of the positive Agreeableness scales, or negatively with at least one of the negative Agreeableness scales

H24: "Adapting to Demands" will correlate negatively with the positive Neuroticism scale, or negatively with the positive Neuroticism scale

H25: “Delivering Results” will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales

H26: “Driving Performance” will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales

Hopton (2012, p. 65) found summing the Great Eight competencies across all eight items correlated in excess of 0.7 with three other measures of overall performance. This offers good evidence to support creating one measure of total performance in this thesis, based on summing the Great Eight competencies. Consequently, based on the correlations between Conscientiousness and overall performance found by Barrick and Mount (1991), the following hypotheses for the BF57 correlations with the Great Eight in this research have been made.

H27: “Sum of All Eight” will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales

Although slightly lower in magnitude than Conscientiousness, Extraversion was also consistently related to overall performance (Barrick & Mount, 1991) and so the following hypothesis was formed:

H28: “Sum of All Eight” will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales

As Judge, Bono, Ilies and Gerhardt (2002) found Neuroticism negatively correlated with overall performance of leaders at work, the following hypothesis has also been made:

H29: “Sum of All Eight” will correlate positively with the negative Neuroticism scale, or negatively with the positive Neuroticism scale

6.1.2.2 14 Point to Point *a priori* Differential Adaptive/Maladaptive Hypotheses

H30: It was hypothesized that for the point to point *a priori* assumed BF57 dimension to Great Eight competency correlations detailed in section 6.1.2.1, the adaptive scales would consistently correlate more highly with the Great Eight competency criterion than the maladaptive scales. This yields a total of 14 possible shifts in correlation coefficients.

For example, the BF57 Openness four scales are expected to correlate with "Analysing Situations". There were two such hypothesised correlations for each of the Great Eight competencies, except "Adapting to Demands" which was excluded as each pole was not measured adaptively and maladaptively for Neuroticism.

6.1.2.3 Differential Adaptive/Maladaptive Hypotheses in all 64 combinations

There are 64 adaptive/maladaptive correlation comparisons that can be made, if each of the 8 competencies is considered to contain 8 comparisons between adaptive and maladaptive (8 x 8 = 64). Each of the 4 O, C, E and A dimensions has two pairs of adaptive/maladaptive correlations underneath it (4 x 2 = 8). Multiplying these 8 by the 8 competencies gives 64 possible comparisons. For example, the two pairs of adaptive/maladaptive scales under Openness are O+ Adaptive vs O+ Maladaptive, and O- Adaptive vs O- Maladaptive.

H31: It was hypothesized across the 64 possibilities, a statistically greater than chance number would show a statistically significant difference in the correlation coefficients between the adaptive and maladaptive scales.

6.1.2.4 Bandwidth versus Fidelity Hypotheses

An analysis was undertaken to shed light on the bandwidth/fidelity debate explored in section 2.7.1 of the literature review of this thesis. For example, Salgado et al. (2013) have presented evidence as to the utility of measuring the Big Five at a high level and generally supported the bandwidth side of the argument. On the other hand, Ashton et al. (2014) have presented evidence in favour of the fidelity side of the debate and argue for more use of lower level facets to predict performance.

As the Great Eight is a behavioural competency model, if the fidelity argument has merit, we may expect higher correlations with combinations of lower order scales in the BF57, rather than the five higher level dimensions. Consequently, it was hypothesised that:

> **H32:** Within each Big Five dimension a regression of the 4 scales for O, C, E and A, and of the 2 scales for N, will produce a stronger relationship (as measured by the multiple correlation coefficient) than for the same items in the BF57 used to create 1 measure of O, C, E, A and N. It is hypothesized that this will be the case for the eight competencies in the Great Eight model.

The logic is, that if a lower level model can account for more variance in the Great Eight data, and this is achieved without the need to add more items, then the fidelity based item grouping is a cleaner and more effective structure than the traditional higher-level bandwidth approach.

6.2 Method

6.2.1 Materials and Procedures

A copy of the Great Eight questionnaire can be found in Appendix I: The Great Eight Items and can be deployed by researchers by referencing this dissertation. The Great Eight was developed by Kurz and Bartram (2002) and the model was chosen to help address the research questions due to the large body of research data available on the model. A refined set of competency titles (Kurz, 2003) was used and supplemented with faceted definitions taken from proprietary Lumina Learning 360 tools. A five-point effectiveness scale was employed. The questionnaire was loaded into an online questionnaire system provided by Lumina Learning LLP and respondent data gathered for the Great Eight competencies (N = 254), Professional competencies (N = 254) and Leadership competencies (N = 73) via two separate sessions (the Great Eight and Professional competencies being gathered in one combined session). The data gathered was then extracted into Microsoft Excel and then imported into SPSS for subsequent analysis.

The data was matched across the instruments and with the BF57 via each participant providing their full name. The data was then anonymised before the

analysis was undertaken. The volunteers filled in the questionnaires at times most convenient to them in a six-month window.

6.2.2 Participants and Design

Those of the 2,506 who had previously indicated they would be willing to support further research were emailed and asked if they would like to nominate somebody to give them workplace based observer feedback.

Norman and Goldberg (1966) had demonstrated that an assessor needs to know the assessee well for 360 observer data to be suitable for validity studies. Consequently, participants were invited to select their own raters to provide them with feedback and the need for the rater to know them well was emphasised. Raters needed to have a perspective on the individual's work performance, but could be partners, family, friends or work colleagues provided they had the work perspective. An introductory email detailed the purpose of the study and provided them with a URL link to forward on to potential raters. The external rater did not need to provide their name, but did input the name of the person they were assessing. A 5-point Likert format was used, with responses ranging from 'highly effective' to 'highly ineffective'. Once a potential rater clicked on the URL link, their informed consent was sought, the study purpose outlined and they were enrolled into giving feedback. If they had any questions they could contact the author.

Observers who completed an assessment were given an invitation to attend one of a number of webinars (online web seminar) if they were interested to know more about the research. Anyone wishing to discuss the process or their experience on a one to one basis were offered the opportunity to do so.

254 raters responded to these invitations and completed the observer questionnaire for the Great Eight and Professional Competencies. The feedback was provided on N = 154 females (mean age = 46.6, SD = 10.4) and N = 100 males (mean age = 49.3, SD = 11.5).

73 raters responded to these invitations and completed the observer questionnaire for the Leadership Competencies. The feedback was provided on N = 48 females (mean age= 44.7, SD = 8.5) and N = 25 males (mean age = 50.0, SD = 11.2).

It was anticipated that many of the original 2,506 would not want to trouble colleagues and invite 360 feedback. It was also inevitably that a number of people approached to give feedback ultimately did not do so, often due to being short of time. Nevertheless, the sample sizes of N = 254 and N = 73 were considered fit for purpose and would provide enough statistical power to undertake meaningful analysis.

6.3 Results: BF57 and Great Eight

6.3.1 Results of 11 Point to Point *a priori* Hypotheses

The following 11 hypotheses (**H19** to **H29**) have been tested using the data in Table 6-2.

The hypothesis for “Analysing Situations” was rejected as all four Openness scales failed to reach statistical significance.

Support was found for the hypothesis for “Creating Concepts” as all four scales within Openness correlated as expected. The highest correlation of -0.26 with Maladaptive Pragmatic (O- Mal) suggests that being overly sensible and practical can limit an individual’s ability to create new concepts.

Support was found for the “Relating to People” hypothesis in that it correlated with 3 out of 4 of the Extraversion scales. Adaptive Extraversion had the most beneficial impact with r = 0.21. However, maladaptive Extraversion was not having a negative effect on this competence and in fact still correlated positively with performance (although not statistically significantly).

Support could not be found for the expected *a priori* positive correlation between Extraversion and “Controlling Resources” and this hypothesis was rejected. However, the data does show that possessing maladaptive Agreeableness or maladaptive Neuroticism works against the effective use of this competence with negative correlations of -0.16 and -0.17 respectively. Being emotionally stable (N-Ada) helps with the “Controlling Resources” competency with r = 0.21.

The hypothesis on “Respecting People” was supported as adaptive Agreeableness supports the competency with r = 0.20. Equally being direct either adaptively (r = -0.22) or maladaptively (r = -0.19) is unhelpful in terms of respecting others.

The hypothesis that “Adapting to Demands” will correlate negatively with Neuroticism (r = -0.35) and positively with Emotional Stability (r = 0.25) was supported.

The hypothesis that “Delivering Results” is supported by Conscientiousness was accepted with the second highest correlation in the table being with adaptive Conscientious (C+ Ada) (r = 0.28) and as expected, being too flexible (C- Mal) correlated negatively with performance at -0.25

The hypothesis for “Driving Performance” was supported with too much flexibility damaging the competence (C- Mal) (r = -0.12). Being direct (A- Ada) helps this competence with r = 0.12 and maladaptive Agreeableness (e.g. people pleasing) damages it (r = -0.13).

The “Sum of All Eight” Conscientiousness hypothesis was supported as being maladaptively flexible (C- Mal) damages overall performance (r = -0.14). Support was also found for Extraversion driving overall performance (E+ Ada r = 0.12). Finally, support was also found that “Sum of All Eight” is helped by being emotionally stable (r = 0.2) and hindered by being neurotic (r = -0.25).

Overall varying levels of support were found for 9 of the 11 *a priori* hypothesis made concerning the correlation between the BF57 and performance at work as measured by the Great Eight competencies.

6.3.2 Results - BF57 Correlations with the Great Eight

Table 6-1: Raw Correlations of BF57 Five Dimensions with Great Eight

	Analysing Situations	Creating Concepts	Relating to People	Controlling Resources	Respecting People	Adapting to Demands	Delivering Results	Driving Performance	Sum of All Eight
BF57 O	.06	.25**	-.03	.03	-.04	.01	-.17**	.03	.04
BF57 C	.09	-.08	-.02	.04	.04	.06	.24**	.09	.08
BF57 E	-.06	.12	.19**	.03	.09	.09	-.04	.08	.09
BF57 A	-.14*	.01	.17**	-.11	.20**	-.05	-.05	-.11	-.02
BF57 N	-.06	-.23**	-.18**	-.21**	-.13*	-.34**	-.12	-.15*	-.25**

*Note: N = 254; * p<0.05 ** p<0.01; Statistically significant correlations with p<0.05 shaded grey.*

Table 6-2: Raw Correlations of BF57 Eighteen Scales with Great Eight

	Analysing Situations	Creating Concepts	Relating to People	Controlling Resources	Respecting People	Adapting to Demands	Delivering Results	Driving Performance	Sum of All Eight
O+ Adaptive	.09	.22**	-.07	.03	-.04	.01	-.12*	.03	.03
O+ Maladaptive	.10	.16*	-.08	-.03	-.10	-.04	-.19**	.03	-.02
O- Adaptive	.02	-.25**	-.08	-.06	-.04	-.06	.13*	-.06	-.08
O- Maladaptive	-.03	-.26**	.01	-.03	.00	-.01	.13*	.01	-.04
C+ Adaptive	.07	-.06	-.02	.04	.06	.08	.28**	.08	.09
C+ Maladaptive	.02	-.16*	-.08	-.08	-.03	-.15*	.11	-.02	-.07
C- Adaptive	-.13*	.06	-.02	-.05	-.06	-.08	-.11	-.11	-.09
C- Maladaptive	-.08	-.01	-.02	-.12	-.04	-.17**	-.25**	-.12*	-.14*
E+ Adaptive	-.05	.12	.21**	.06	.11	.10	.03	.08	.12*
E+ Maladaptive	.02	.09	.09	-.04	-.01	-.01	-.10	.10	.03
E- Adaptive	.10	-.10	-.18**	-.02	-.07	-.09	.03	-.06	-.07
E- Maladaptive	.09	-.10	-.20**	-.06	-.14*	-.14*	.04	-.05	-.10
A+ Adaptive	-.09	.04	.19**	-.05	.20**	-.03	-.01	-.06	.03
A+ Maladaptive	-.09	-.08	.01	-.16*	.04	-.13*	-.10	-.13*	-.12
A- Adaptive	.12*	.02	-.14*	.11	-.22**	.05	.04	.12*	.03
A- Maladaptive	.13*	-.10	-.22**	.02	-.19**	-.05	.02	.05	-.06
N+ Maladaptive	-.05	-.20**	-.20**	-.17**	-.15*	-.35**	-.13*	-.13*	-.25**
N- Adaptive	.06	.22**	.13*	.21**	.07	.25**	.07	.13*	.20**

*Note: N = 254; * p<0.05 ** p<0.01; Statistically significant correlations with p<0.05 shaded grey.*

6.3.3 Results for 14 Point to Point Adaptive/Maladaptive Hypotheses

Evidence was found that for the 14-hypothesized point to point *a priori* BF57 dimension to Great Eight competency correlations detailed in section 6.1.2 (e.g. the BF57 Openness four scales are expected to correlate with “Analysing Situations”), the adaptive scales correlated more highly with the criterion than the maladaptive scales on 12 occasions. The exact probability of at least this number of differences can be calculated from the binomial distribution and is equal to 0.008078. This offers evidence to suggest the adaptive scales do correlate more highly with performance than the maladaptive measures. Evidence has therefore been found to support hypothesis **H30**.

6.3.4 Results for all 64 Adaptive/Maladaptive Hypotheses

6.3.4.1 Relating to People

The maladaptive measure of Extraversion (E+ Mal) had a significantly lower correlation ($r = 0.21$ cf. $r = 0.09$, $Z_h = 2.38$, $p = 0.017$) than the adaptive measure.

The maladaptive measure of Agreeableness (people pleasing*)* had a significantly lower correlation ($r = 0.19$ cf. $r = 0.01$, $Z_h = 2.90$, $p = 0.004$) suggesting that although too much people pleasing may harm other competencies (e.g. Driving Performance and Controlling Resources), it is not harmful to “Relating to People”.

6.3.4.2 Controlling Resources

The maladaptive measure of Agreeableness (e.g. people pleasing) had a marginally significant higher correlation ($r = -0.05$ cf. $r = -0.16$, $Z_h = 1.86$, $p = 0.06$).

6.3.4.3 Respecting People

The maladaptive measure of Agreeableness had a significantly lower correlation ($r = 0.20$ cf. $r = 0.04$, $Z_h = 2.85$, $p = 0.004$).

6.3.4.4 Delivering Results

The maladaptive measure of Conscientiousness produced a significantly lower correlation ($r = 0.28$ cf. $r = 0.13$, $Z_h = 2.59$, $p = 0.009$).

The maladaptive measure of negative Conscientiousness (C- Mal) produced a significantly lower correlation ($r = 0.28$ cf. $r = 0.13$, $Z_h = 2.59$, $p = 0.009$) than the adaptive (C- Ada).

Of the 64 possible comparisons between adaptive and maladaptive scales, 6 of these proved to be statistically significantly different. The exact probability of at least this number of significant differences can be calculated from the binomial distribution and is equal to 0.10 a figure which is marginally significant. This offers further evidence to suggest there are differences in the validities between adaptive and maladaptive measures of the BF57 and the Great Eight. Some evidence has therefore been found to support hypothesis **H31**.

6.3.5 Results of BF57 Bandwidth versus Fidelity Hypotheses

Table 6-3 shows all eight of the Great Eight competencies have an increase in the multiple correlation coefficient (R) when moving from correlating one of the Big Five dimensions of the BF57 with the competence, compared with the R based on a regression in which the competence is now predicted by the underlying scales of the same Big Five dimension. The probability by chance that all eight competencies will show a stronger relationship when a fidelity approach is taken is 1 in 2^8, which is equal to 0.00391. Thus, the current pattern of results is highly significant and provides evidence to support the fidelity side of the bandwidth/fidelity debate. Evidence has therefore been found to support hypothesis **H32**.

Table 6-3: Incremental validity benefit of eighteen scales over five dimensions

Great Eight Competence	*A priori* Hypothesis	R - Big Five (Bandwidth)	Scales Regressed	R – All Scales Regressed
Analysing Situations: Demonstrating Analytical Thinking; Solving Complex Problems; Critically Evaluating Information	O	.06	O+ Ada, O+ Mal, O- Ada, O- Mal	.16
Creating Concepts: Being Creative and Innovating; Thinking Strategically; Driving Organisational Change	O	.25	O+ Ada, O+ Mal, O- Ada, O- Mal	.27
Relating to People: Displaying Good Interpersonal Skills; Exercising Active Listening; Communicating Effectively	E	.19	E+ Ada, E+ Mal, E- Ada, E- Mal	.24
Controlling Resources: Leading and Directing Others; Managing People and Resources Effectively; Being Decisive; Making Sound Judgments	E	.03	E+ Ada, E+ Mal, E- Ada, E- Mal	.14
Respecting People: Giving Support; Building Team Spirit; Showing Compassion and Being Approachable	A	.20	A+ Ada, A+ Mal, A- Ada, A- Mal	.28
Adapting to Demands: Showing Composure; Working Effectively Under Pressure; Dealing with Ambiguity	N	.34	N+ Mal, N- Ada	.35
Delivering Results: Planning and Organising Efficiently; Working Diligently; Completing Tasks On Time	C	.24	C+ Ada, C+ Mal, C- Ada, C- Mal	.31
Driving Performance: Having Career Ambition; Setting and Achieving Ambitious Work Objectives; Showing Business Acumen	C	.09	C+ Ada, C+ Mal, C- Ada, C- Mal	.16

6.3.6 Results of BF57 maladaptive & HDS maladaptive correlations with Great Eight

Table 6-4: Dark side HDS correlations with Great Eight behavioural competencies

	Analysing Situations	Creating Concepts	Relating to People	Controlling Resources	Respecting People	Adapting to Demands	Delivering Results	Driving Performance	Sum of All Eight
Excitable	.03	-.24	-.20	-.10	-.34*	-.20	-.08	-.21	-.22
Skeptical	-.03	-.16	-.25	-.16	-.25	-.19	-.03	-.13	-.20
Cautious	-.19	-.28*	-.12	-.28*	-.16	-.21	.05	-.29*	-.26
Reserved	.30*	-.10	-.31*	.01	-.31*	.06	.03	.13	-.03
Leisurely	-.11	-.31*	-.03	-.19	-.12	.00	-.12	-.13	-.18
Bold	-.02	.08	.35**	.18	-.05	.08	-.06	.09	.12
Mischievous	-.15	.04	.17	.12	-.08	.02	-.19	.14	.03
Colorful	-.10	.17	.33*	.04	.09	.04	-.10	.05	.10
Imaginative	-.14	.08	-.02	-.13	-.09	-.08	-.21	.01	-.09
Diligent	.30*	-.03	-.01	.05	-.02	.16	.27*	.09	.13
Dutiful	.02	-.13	.16	.02	.16	.11	.09	-.04	.06

*Note: N = 56; * p<0.05; Statistically significant correlations with p<0.05 shaded grey.*

Although the above table is based on just 56 people, a number of the correlations are statistically significant. The “Moving Away” HDS traits correlate negatively with Great Eight performance e.g. Excitable correlates -0.34 with Respecting People and Cautious correlates -0.29 with Driving Performance. However, the Diligent HDS trait from “Moving Toward” correlates 0.30 and 0.27 with Analysing Situations and Delivering Results, with no significant negative correlations. Equally, the “Moving Against” HDS traits of Bold and Colourful have 0.35 and 0.33 correlations with Relating to People. The negative impact of the HDS dark side traits is not so evident in Bold and Colorful in this sample.

Table 6-5: Maladaptive BF57 correlations with Great Eight behavioural competencies

	Analysing Situations	Creating Concepts	Relating to People	Controlling Resources	Respecting People	Adapting to Demands	Delivering Results	Driving Performance	Sum of All Eight
O+ Maladaptive	0.1	.16*	-0.08	-0.03	-0.1	-0.04	-.19**	0.03	-0.02
O- Maladaptive	-0.03	-.26**	0.01	-0.03	0.00	-0.01	.13*	0.01	-0.04
C+ Maladaptive	0.02	-.16*	-0.08	-0.08	-0.03	-.15*	0.11	-0.02	-0.07
C- Maladaptive	-0.08	-0.01	-0.02	-0.12	-0.04	-.17**	-.25**	-.12*	-.14*
E+ Maladaptive	0.02	0.09	0.09	-0.04	-0.01	-0.01	-0.1	0.1	0.03
E- Maladaptive	0.09	-0.1	-.20**	-0.06	-.14*	-.14*	0.04	-0.05	-0.1
A+ Maladaptive	-0.09	-0.08	0.01	-.16*	0.04	-.13*	-0.1	-.13*	-0.12
A- Maladaptive	.13*	-0.1	-.22**	0.02	-.19**	-0.05	0.02	0.05	-0.06
N+ Maladaptive	-0.05	-.20**	-.20**	-.17**	-.15*	-.35**	-.13*	-.13*	-.25**

*Note: N = 254; * p<0.05 ** p<0.01; Statistically significant correlations with p<0.05 shaded light grey; Statistically significant correlations with p<0.01 shaded dark grey.*

The 8 competencies by 11 HDS scales in Table 6-4 yield 88 correlations.

The 8 competencies by 9 BF57 maladaptive scales in Table 6-5 yield 72 correlations.

Of the 88 cells in Table 6-4, 43 correlate positively with their competency and 45 negatively, which equates to 51% correlating negatively.

Of the 72 cells in Table 6-5, 20 correlate positively with their competency and 52 negatively, which equates to 72% correlating negatively.

With an average of 45 occasions (equating to 51%) of the HDS scales correlating negatively in the sample, no evidence was found that the 88 HDS scale correlations with the Great Eight are more likely than chance to correlate either positively or negatively. It is also noted the sample size is only 56 and this will be limiting the statistical power available for this analysis.

With an average of 52 occasions (equating to 72%) of the BF57 scales correlating negatively in the sample, evidence was found that the 72 maladaptive BF57 scale correlations with the Great Eight are more likely than chance to correlate negatively. The exact probability of 52 or more correlating negatively can be calculated from the binomial distribution and is equal to $p < .000001$. This does offer some evidence to suggest the BF57 maladaptive scales are more likely to correlate negatively than positively with performance, across a range of competencies.

6.3.7 Results: Correlations of Professional Competencies with Great Eight Competencies

Table 6-6: Raw Correlations of Professional Competencies with Great Eight Competencies helps cross refer analysis between the Great Eight and Professional Competencies model. The first column of the table details the summary names of the eighteen Professional Competencies, measured by summing the lower level items that measure them. The first four Professional Competencies have been clustered together as they all relate to an individual being a 'pioneer'. The second cluster of four Professional Competencies relate to an individual's ability to 'influence' others. The third cluster of four Professional Competencies help an individual 'deliver'. The fourth cluster of four Professional Competencies have been termed 'people' competencies. Finally, the fifth cluster of two Professional Competencies are concerned with 'overall performance' and are made up of four lower level competencies measuring 'processing abilities' (see Table 6-11) and three measuring 'global performance' (see Table 6-12).

As mentioned previously, there are some differences between European countries views on suitable concurrent validity standards. The European Federation of Psychologists Association (EFPA) considers two scales to be the same for concurrent validity purposes, if their correlation is 0.55 or above. Table 6-6 has shaded grey cells above 0.55 and a darker grey if the correlation is above 0.70. It is worth noting the BPS equivalent standard is 0.45.

The correlations between the professional competencies (*shown in italics below*) and the Great Eight provide further evidence for the utility of the measures of professional competence beyond their face validity. For example, *Adapting to*

change correlated most highly (r = 0.59) with Adapting to Demands from the Great Eight measures. *Pursuing self-development* was most highly correlated (r = 0.38) with Driving Performance; *Fostering Creativity* with Creating Concepts (r = 0.60); *Conceptualising Strategy* with Creating Concepts (r = 0.62); *Showing Resilience* with Adapting to Demands (r = 0.62); *Engaging and Energising* with Relating to People (r = 0.59); *Providing Direction* with Controlling Resources/Managing People (r = 0.71); *Communicating Effectively* with Controlling Resources/Managing People (r = 0.52); *Pursuing and Achieving Goals* with Delivering Results (0.68); *Planning and Organising* with Delivering Results (r = 0.65); *Ensuring Accountability* with Delivering Results (r = 0.53), Relating to People (r = 0.52) and Respecting People (r = 0.52); *Gathering and Analysing Information* with Analysing Situations (r = 0.66); *Being interpersonally astute* with Relating to People (r = 0.71); *Coaching and Developing Others* with Relating to People (r = 0.60); *Supporting Others* with Respecting People (r = 0.61) and *Working Together* with Respecting People (r = 0.71). Finally, in measures of overall performance *Processing Ability* was most highly correlated with Analysing Situations (r = 0.67) and Global Performance with the Total Great Eight score (r = 0.71).

Table 6-6: Raw Correlations of Professional Competencies with Great Eight Competencies

	Analysing Situations	Creating Concepts	Relating to People	Controlling Resources	Respecting People	Adapting to Demands	Delivering Results	Driving Performance	Sum of All Eight
Pioneering									
Adapting to Change	0.34**	0.51**	0.48**	0.42**	0.42**	0.59**	0.34**	0.44**	0.64**
Pursuing Self-development	0.27**	0.33**	0.38**	0.32**	0.30**	0.22**	0.29**	0.38**	0.45**
Fostering Creativity	0.30**	0.60**	0.43**	0.44**	0.35**	0.44**	0.31**	0.40**	0.60**
Conceptualising Strategy	0.55**	0.62**	0.29**	0.53**	0.27**	0.48**	0.40**	0.58**	0.69**
Influence									
Showing Resilience	0.27**	0.39**	0.53**	0.41**	0.42**	0.62**	0.26**	0.34**	0.59**
Engaging & Energising	0.14*	0.37**	0.59**	0.25**	0.50**	0.36**	0.24**	0.34**	0.50**
Providing Direction	0.41**	0.50**	0.40**	0.71**	0.37**	0.56**	0.48**	0.61**	0.74**
Communicating Effectively	0.36**	0.47**	0.45**	0.52**	0.35**	0.45**	0.40**	0.46**	0.63**
Delivery									
Pursuing & Achieving Goals	0.50**	0.36**	0.33**	0.44**	0.35**	0.56**	0.68**	0.49**	0.67**
Planning & Organising	0.42**	0.32**	0.29**	0.48**	0.29**	0.38**	0.65**	0.43**	0.59*
Ensuring Accountability	0.29**	0.31**	0.52**	0.39**	0.52**	0.43**	0.53**	0.37**	0.61**
Gathering & Analysing Information	0.66**	0.61**	0.41**	0.29**	0.53**	0.27**	0.49**	0.54**	0.65**
People									
Being Interpersonally Astute	0.07	0.27**	0.71**	0.23**	0.66**	0.38**	0.15*	0.16*	0.47**
Coaching & Developing Others	0.25**	0.45**	0.60**	0.51**	0.58**	0.47**	0.32**	0.36**	0.64**
Supporting Others	0.22**	0.34**	0.56**	0.44**	0.61**	0.42**	0.41**	0.35**	0.60**
Working Together	0.15*	0.27**	0.69**	0.33**	0.71**	0.38**	0.31**	0.19**	0.54**
Overall Performance									
Processing Ability	0.67**	0.31**	0.14*	0.41**	0.15*	0.40**	0.49**	0.37**	0.54**
Global Performance	0.51**	0.54**	0.31**	0.53**	0.29**	0.48**	0.52**	0.67**	0.71**

*Note: N = 254; * p<0.05 ** p<0.01; Left hand column details 'Professional Competencies'; Top row details 'Great Eight' Competencies.*

6.4 Results: BF57 and Professional Competencies

Correlations of the BF57 with Professional Competencies follow.

Table 6-7: Raw Correlations of BF57 with Pioneering Professional Competencies

	Adapting to Change	Pursuing Self-development	Fostering Creativity	Conceptualising Strategy
O+ Adaptive	.07	.05	.17**	.16*
O+ Maladaptive	.04	.02	.09	.13*
O- Adaptive	-.19**	-.15*	-.23**	-.13*
O- Maladaptive	-.15*	-.14*	-.20**	-.10
C+ Adaptive	.03	-.07	.00	.05
C+ Maladaptive	-.24**	-.12	-.16**	-.07
C- Adaptive	.04	-.02	.05	-.05
C- Maladaptive	-.13*	.01	-.01	-.07
E+ Adaptive	.19**	.14*	.26**	.08
E+ Maladaptive	.12*	.01	.13*	.06
E- Adaptive	-.15*	-.09	-.14*	-.05
E- Maladaptive	-.19**	-.17**	-.19**	-.06
A+ Adaptive	.01	.14*	.07	-.05
A+ Maladaptive	-.16*	-.01	-.11	-.14*
A- Adaptive	.06	-.09	.05	.11
A- Maladaptive	-.08	-.19**	-.06	.09
N+ Maladaptive	-.35**	-.13*	-.22**	-.21**
N- Adaptive	.26**	.04	.18**	.22**

*Note: N = 254; * p<0.05 light grey shaded; ** p<0.01 dark grey shaded.*

6.4.1 Adapting to Change

The maladaptive measure of positive Agreeableness (A+ Mal) produced a significantly higher negative correlation (r = 0.01 cf. r = -0.16, Z_h = 2.79, p = 0.005) than the adaptive (A+ Ada).

The maladaptive measure of positive Conscientiousness (C+ Mal) produced a significantly higher negative correlation (r = 0.03 cf. r = -0.24, Z_h = 4.25, p < 0.001) than the adaptive (C+ Ada). Also, the maladaptive measure of negative Conscientiousness (C- Mal), termed ‘Flexible’ produced a significantly higher

negative correlation (r = 0.04 cf. r = -0.13, Z_h = 2.76, p = 0.006) than the adaptive (C- Ada).

6.4.2 Pursuing Self-Development

The maladaptive measure of being too direct (A- Mal) produced a marginally significantly higher correlation (r = -0.09 cf. r = -0.19, Z_h = 1.82, p = 0.069).

The maladaptive measure of being agreeable (A+ Mal) had a significantly lower correlation (r = 0.14 cf. r = -0.01, Z_h = 2.46, p = 0.014).

The maladaptive measure of Extraversion (E+ Mal) had a significantly lower correlation (r = 0.14 cf. r = 0.01, Z_h = 2.41, p = 0.016).

The maladaptive measure of Introversion (E- Mal) had a marginally significantly different and higher correlation (r = -0.09 cf. r = -0.17, Z_h = 1.89, p = 0.059).

6.4.3 Fostering Creativity

The maladaptive measure of Conscientiousness (C+ Mal) produced a significantly higher negative correlation (r = 0.00 cf. r = -0.16, Z_h = 2.5, p = 0.012).

For this cluster of four 'Pioneering' competencies *(Adapting to Change, Pursuing Self-development, Fostering Creativity and Conceptualising Strategy),* of the 32 possible comparisons between adaptive and maladaptive scales, 6 of these proved to be statistically significant and a further 2 marginally statistically significant. The exact probability of at least 6 significant differences can calculated from the binomial distribution and is equal to p = .00459975. This offers further evidence for the validity of differentiating between adaptive and maladaptive measures.

Table 6-8: Raw Correlations of BF57 with Influencing Professional Competencies

	Showing Resilience	Engaging & Energising	Providing Direction	Communicating Effectively
O+ Adaptive	.03	.04	-.04	.09
O+ Maladaptive	-.04	-.05	-.05	.02
O- Adaptive	-.14*	-.16**	.01	-.06
O- Maladaptive	-.10	-.12	.01	-.15*
C+ Adaptive	.01	.09	.07	.09
C+ Maladaptive	-.17**	-.12	-.03	-.12
C- Adaptive	-.04	-.01	-.09	-.07
C- Maladaptive	-.16**	-.10	-.16*	-.16*
E+ Adaptive	.18**	.38**	.08	.22**
E+ Maladaptive	.03	.24**	.04	.11
E- Adaptive	-.14*	-.32**	-.09	-.19**
E- Maladaptive	-.19**	-.35**	-.04	-.21**
A+ Adaptive	.02	.21**	-.03	.01
A+ Maladaptive	-.21**	-.03	-.19**	-.20**
A- Adaptive	.02	-.10	.12	.17**
A- Maladaptive	-.15*	-.17**	.05	.02
N+ Maladaptive	-.47**	-.21**	-.24**	-.32**
N- Adaptive	.33**	.19**	.20**	.24**

*Note: N = 254; * p<0.05 light grey shaded; ** p<0.01 dark grey shaded.*

6.4.4 Showing Resilience

The maladaptive measure of being Disagreeable (A- Mal) produced a significantly higher correlation (r = 0.02 cf. r = -0.15, Z_h = 3.06, p = 0.002).

The maladaptive measure of being Agreeable (A+ Mal) had a significantly higher correlation (r = 0.02 cf. r = -0.21, Z_h = 3.8, p < 0.001).

The maladaptive measure of being low Conscientiousness (C- Mal) produced a significantly higher correlation (r = -0.04 cf. r = -0.16, Z_h = 1.95, p = 0.05).

The maladaptive measure of being high Conscientiousness (C+ Mal) produced a significantly higher correlation (r = 0.01 cf. r = -0.17, Z_h = 2.5, p = 0.012).

The maladaptive measure of Extraversion had a significantly lower correlation (r = 0.18 cf. r = 0.03, Z_h = 2.79, p = 0.005).

6.4.5 Engaging and Energising

The maladaptive measure of being Agreeable (A+ Mal) had a significantly lower correlation (r = 0.21 cf. r = -0.03, Z_h = 3.96, p < 0.001).

The maladaptive measure of Extraversion (E+ Mal) had a significantly lower correlation (r = 0.38 cf. r = 0.24, Z_h = 2.74, p = 0.006).

6.4.6 Providing Direction

The maladaptive measure of being Agreeable (A+ Mal) had a significantly higher correlation (r = -0.03 cf. r = -0.19, Z_h = 2.64, p = 0.008).

6.4.7 Communicating Effectively

The maladaptive measure of being Disagreeable (A- Mal) produced a significantly lower correlation (r = 0.17 cf. r = 0.02, Z_h = 2.71, p = 0.007).

The maladaptive measure of being Agreeable (A+ Mal) had a significantly higher correlation (r = 0.01 cf. r = -0.20, Z_h = 3.46, p < 0.001).

The maladaptive measure of Extraversion (E+ Mal) had a significantly lower correlation (r = 0.22 cf. r = 0.11, Z_h = 2.06, p = 0.039).

The maladaptive measure of being low Openness (O- Mal) had a marginally significantly higher correlation (r = -0.06 cf. r = -0.15, Z_h = 1.77, p = 0.077).

For this cluster of four ‘Influencing’ competencies *(Showing Resilience, Engaging & Energising, Providing Direction, Communicating Effectively),* of the 32 possible comparisons between adaptive and maladaptive scales, 11 of these proved to be statistically significant and 1 marginally statistically significant. The exact probability of at least 11 significant differences can calculated from the binomial distribution and is equal to 0.00000024. This offers further evidence for the validity of differentiating between adaptive and maladaptive measures.

Table 6-9: Raw Correlations of BF57 with Delivering Professional Competencies

	Pursuing & Achieving Goals	Planning & Organising	Ensuring Accountability	Gathering & Analysing Information
O+ Adaptive	-.01	-.19**	-.15*	-.02
O+ Maladaptive	-.12	-.22**	-.13*	-.05
O- Adaptive	.02	.20**	.06	.09
O- Maladaptive	.03	.18**	.09	.05
C+ Adaptive	.25**	.27**	.09	.13*
C+ Maladaptive	.07	.24**	.01	.01
C- Adaptive	-.14*	-.20**	-.06	-.07
C- Maladaptive	-.27**	-.23**	-.09	-.12
E+ Adaptive	.07	-.09	.03	-.08
E+ Maladaptive	-.01	-.17**	-.13*	-.12
E- Adaptive	-.04	.11	.03	.10
E- Maladaptive	-.07	.13*	-.01	.10
A+ Adaptive	-.05	.05	.17**	-.03
A+ Maladaptive	-.15*	-.03	.02	-.09
A- Adaptive	.10	-.07	-.11	.09
A- Maladaptive	.06	-.05	-.11	.08
N+ Maladaptive	-.23**	-.01	-.16*	-.09
N- Adaptive	.14*	.01	.06	.09

*Note: N = 254; * p<0.05 light grey shaded; ** p<0.01 dark grey shaded.*

6.4.8 Pursuing and Achieving Goals

The maladaptive measure of being low Conscientiousness (C- Mal) produced a significantly higher correlation (r = -0.14 cf. r = -0.27, Z_h = 2.16, p = 0.03). The maladaptive measure of being high Conscientiousness (C+ Mal) produced a significantly lower correlation (r = 0.25 cf. r = 0.07, Z_h = 2.85, p = 0.004).

6.4.9 Ensuring Accountability

The maladaptive measure of being Agreeable (A+ Mal) had a significantly lower correlation (r = 0.17 cf. r = 0.02, Z_h = 2.47, p = 0.013).

The maladaptive measure of Extraversion (E+ Mal) had a significantly higher correlation (r = 0.03 cf. r = -0.13, Z_h = 2.96, p = 0.003).

6.4.10 Gathering and Analysing Information

The maladaptive measure of being high Conscientiousness (C+ Mal) produced a marginally significant lower correlation (r = 0.13 cf. r = 0.01, Z_h = 1.87, p = 0.061).

For this cluster of four 'Delivery' competencies *(Pursuing & Achieving Goals, Planning & Organising, Ensuring Accountability, Gathering & Analysing Information),* of the 32 possible comparisons between adaptive and maladaptive scales, 4 of these proved to be statistically significant and 1 marginally statistically significant. The exact probability of at least 4 significant differences can calculated from the binomial distribution and is equal to 0.07381. This offers further evidence for the validity of differentiating between adaptive and maladaptive measures.

Table 6-10: Raw Correlations of BF57 with People Professional Competencies

	Being Interpersonally Astute	**Coaching & Developing Others**	**Supporting Others**	**Working Together**
O+ Adaptive	-.05	.07	-.07	-.05
O+ Maladaptive	-.12	-.03	-.13*	-.09
O- Adaptive	-.11	-.14*	-.09	-.01
O- Maladaptive	-.08	-.11	.01	.00
C+ Adaptive	-.07	.07	.01	.05
C+ Maladaptive	-.15*	-.10	-.06	-.08
C- Adaptive	.04	-.03	.01	-.07
C- Maladaptive	-.01	-.14*	-.04	-.09
E+ Adaptive	.23**	.26**	.14*	.09
E+ Maladaptive	.06	.10	-.03	-.05
E- Adaptive	-.19**	-.21**	-.09	-.07
E- Maladaptive	-.22**	-.21**	-.14*	-.12
A+ Adaptive	.22**	.10	.28**	.15*
A+ Maladaptive	-.01	-.13*	.08	-.03
A- Adaptive	-.16*	.00	-.22**	-.09
A- Maladaptive	-.24**	-.14*	-.25**	-.16*
N+ Maladaptive	-.24**	-.33**	-.15*	-.18**
N- Adaptive	.12	.20**	.04	.14*

*Note: N = 254; * p<0.05 light grey shaded; ** p<0.01 dark grey shaded.*

6.4.11 Being Interpersonally Astute

The maladaptive measure of being Agreeable (A+ Mal) produced a significantly lower correlation ($r = 0.22$ cf. $r = -0.01$, $Z_h = 3.8$, $p < 0.001$).

The maladaptive measure of Extraversion (E+ Mal) had a significantly lower correlation ($r = 0.23$ cf. $r = 0.06$, $Z_h = 3.18$, $p = 0.001$).

6.4.12 Coaching and Developing Others

The maladaptive measure of being (A- Mal) produced a significantly greater correlation ($r = 0.00$ cf. $r = -0.14$, $Z_h = 2.52$, $p = 0.011$).

The maladaptive measure of being low on Conscientiousness (C- Mal) produced a significantly higher correlation ($r = 0.03$ cf. $r = -0.14$, $Z_h = 2.76$, $p = 0.006$).

The maladaptive measure of Extraversion (E+ Mal) had a significantly lower correlation ($r = 0.26$ cf. $r = 0.10$, $Z_h = 3.01$, $p = 0.003$).

6.4.13 Supporting Others

The maladaptive measure of being Agreeable (A+ Mal) produced a significantly lower correlation ($r = 0.28$ cf. $r = 0.08$, $Z_h = 3.35$, $p < 0.001$).

The maladaptive measure of Extraversion (E+ Mal) had a significantly different and lower correlation ($r = 0.14$ cf. $r = -0.03$, $Z_h = 3.14$, $p = 0.002$).

6.4.14 Working Together

The maladaptive measure of being Agreeable (A+ Mal) had a significantly lower correlation ($r = 0.15$ cf. $r = -0.03$, $Z_h = 2.96$, $p = 0.003$).

For this cluster of four ‘People’ competencies *(Being Inter-personally, Astute, Coaching & Developing Others, Supporting Others and Working Together),* of the 32 possible comparisons between adaptive and maladaptive scales, 8 of these proved to be statistically significant. The exact probability of at least this number of significant differences can calculated from the binomial distribution and is equal to

0.000139. This offers further evidence for the validity of differentiating between adaptive and maladaptive measures.

6.4.15 Processing Ability and Global Performance

Table 6-11: Raw Correlations of BF57 with Overall Performance Professional Competencies

	Processing Ability	Global Performance
O+ Adaptive	-.07	.08
O+ Maladaptive	-.06	-.02
O- Adaptive	.17**	-.09
O- Maladaptive	.13*	-.03
C+ Adaptive	.15*	.10
C+ Maladaptive	.15*	-.03
C- Adaptive	-.20**	-.12
C- Maladaptive	-.14*	-.15*
E+ Adaptive	-.16*	.09
E+ Maladaptive	-.18**	-.03
E- Adaptive	.20**	.02
E- Maladaptive	.24**	-.01
A+ Adaptive	-.05	-.02
A+ Maladaptive	.00	-.10
A- Adaptive	.08	.09
A- Maladaptive	.06	-.07
N+ Maladaptive	.03	-.19**
N- Adaptive	-.01	.19**

*Note: N = 254; * p<0.05 light grey shaded; ** p<0.01 dark grey shaded.*

Based on Table 6-11: Raw Correlations of BF57 with Overall Performance Professional Competencies being “Pragmatic” (low Openness) combined with Introversion and Conscientiousness, helps an individual with their “Processing Abilities”. Interestingly however, in Table 6-13: Raw Correlations of BF57 with Global Performance, these same BF57 scales (O- Ada; E- Ada; C+ Ada) do not help with “Developing Growth Potential”.

“Processing Ability” was based on four sub-competencies assessed as follows:

i. Using Words (Constructing Logical Arguments; Writing Fluently and Concisely; Communicating Clearly)

ii. Using Numbers (Understanding Numerical Data; Analysing Data; Interpreting Graphs)

iii. Focusing on Details (Demonstrating Attention to Detail; Being able to Spot Errors; Intricate Planning)

iv. Using Technology (Utilising IT Effectively; Fast Learner of New Technology; Working Effectively with Software Applications)

“Global Performance” was based on three sub-competencies assessed as follows:

i. Applying Expert Knowledge (Developing Expertise; Contributing Specialist Skills; Sharing Knowledge)

ii. Accomplishing Goals (Achieving Personal Objectives; Furthering Team Objectives; Pursuing Organisational Goals)

iii. Demonstrating Growth Potential (Demonstrating Potential for Promotion; Pursuing Career Progression; Being Organisationally Savvy)

The correlation of these sub-competencies with the BF57 scales is shown in the next two tables.

Table 6-12: Raw Correlations of BF57 with Processing Abilities

	Using Words	Using Numbers	Focusing on Details	Using Technology
O+ Adaptive	.01	-.04	-.16**	.00
O+ Maladaptive	-.07	-.02	-.19**	.09
O- Adaptive	.01	.16**	.20**	.11
O- Maladaptive	-.04	.11	.18**	.08
C+ Adaptive	.07	.10	.19**	.06
C+ Maladaptive	.05	.09	.17**	.12
C- Adaptive	-.11	-.13*	-.21**	-.14*
C- Maladaptive	-.12	-.09	-.22**	.01
E+ Adaptive	-.04	-.14*	-.15*	-.12
E+ Maladaptive	-.11	-.07	-.23**	-.11
E- Adaptive	.10	.10	.19**	.20**
E- Maladaptive	.10	.19**	.19**	.21**
A+ Adaptive	.03	-.12*	.01	-.06
A+ Maladaptive	-.04	-.02	-.04	.08
A- Adaptive	-.04	.12*	.02	.10
A- Maladaptive	-.10	.19**	-.02	.07
N+ Maladaptive	-.03	-.01	.00	.12
N- Adaptive	.08	-.02	.01	-.07

*Note: N = 254; * p<0.05 light grey shaded; ** p<0.01 dark grey shaded.*

The table above shows that N+ Maladaptive correlates with “Using Technology” with r = 0.12. It is on the edge of statistical significance. Interestingly, Introversion also helps with “Using Technology”, as it also does with both “Using Numbers” and “Focusing on Details”.

Table 6-13: Raw Correlations of BF57 with Global Performance

	Applying Expert Knowledge	Accomplishing Goals	Demonstrating Growth Potential
O+ Adaptive	.09	-.04	.12
O+ Maladaptive	.00	-.07	.01
O- Adaptive	.00	-.02	-.16**
O- Maladaptive	-.05	.05	-.07
C+ Adaptive	.11	.17**	-.02
C+ Maladaptive	.05	-.02	-.09
C- Adaptive	-.03	-.14*	-.11
C- Maladaptive	-.09	-.21**	-.07
E+ Adaptive	.04	.10	.07
E+ Maladaptive	-.07	.00	.00
E- Adaptive	.07	-.03	-.01
E- Maladaptive	.05	-.03	-.04
A+ Adaptive	.03	-.06	-.02
A+ Maladaptive	-.04	-.13*	-.07
A- Adaptive	.08	.10	.04
A- Maladaptive	-.02	-.03	-.10
N+ Maladaptive	-.05	-.22**	-.16**
N- Adaptive	.10	.20**	.15*

*Note: N = 254; * p<0.05 light grey shaded; ** p<0.01 dark grey shaded.*

6.5 Results: BF57 and Leadership Competencies

For the sixteen leadership competencies, no significant correlations were found between any of the 18 lower level BF57 scales and *Strategic Thinking, Holds Self and Others Accountable, Interpersonally Astute, Coaches & Develops Others, Win-Win Partnering, Provides Clear Directives and Drive & Determination.*

Aggregating the sixteen leadership competencies up to four competency domains, finds no significant positive correlations between any of the 18 lower level categories and *Leading Through People* and *Leading with Drive.*

Unsurprisingly, given the moderate effect sizes and relatively low sample size, no significant differences were found in the magnitude of the correlation between the maladaptive and adaptive measures.

Despite the challenges of low statistical power, some similarities can be seen with the Great Eight and the professional competencies model. For example, Openness is correlating 0.27** with Inspiring and Energising Others, and 0.31*** with Champions Innovation. Conscientiousness correlated with Data Gathering and Analysis at 0.23**. Extraversion correlates with Purposeful Argumentation at 0.28**. In this leadership data set, Agreeableness does not have any significant positive correlation with performance at work (although the sample size is small).

Table 6-14: Raw Correlations of BF57 with Leadership Competencies

	Passion for Learning	Strategic Thinking	Inspires and Energises Others	Champions Innovation
O+ Adaptive	.21*	.13	.27**	.31***
O+ Maladaptive	.14	.06	.15	.22*
O- Adaptive	-.26**	-.16	-.30***	-.30***
O- Maladaptive	-.24**	-.13	-.21*	-.30**
C+ Adaptive	-.08	.02	-.13	-.01
C+ Maladaptive	-.17	-.05	-.22*	-.15
C- Adaptive	.05	-.08	.01	.05
C- Maladaptive	.00	-.16	.04	-.07
E+ Adaptive	.17	.18	.20*	.14
E+ Maladaptive	.07	.17	.16	.09
E- Adaptive	-.04	-.10	-.10	-.03
E- Maladaptive	-.02	-.02	-.11	-.03
A+ Adaptive	.08	-.12	-.06	.08
A+ Maladaptive	-.03	-.14	-.14	-.02
A- Adaptive	-.03	.12	.12	-.06
A- Maladaptive	-.06	.15	.08	-.07
N+ Maladaptive	-.19*	-.18	-.18	-.22*
N- Adaptive	.01	-.01	.03	.05

*Note: N = 73; * p<0.1 light grey shaded; ** p<0.05 dark grey shaded; *** p<0.01 dark grey shaded.*

Table 6-14: Raw Correlations of BF57 with Leadership Competencies continued

	Calm Under Pressure	Data Gathering and Analysis	Holds Self and Others Accountable	Planning and Follow Through
O+ Adaptive	.06	-.21*	.08	-.11
O+ Maladaptive	-.07	-.18	-.01	-.17
O- Adaptive	-.17	.11	-.15	.01
O- Maladaptive	-.10	.06	-.08	.00
C+ Adaptive	-.02	.23**	-.10	.21*
C+ Maladaptive	-.10	.15	-.09	.12
C- Adaptive	-.08	-.30***	.00	-.25**
C- Maladaptive	-.06	-.45***	-.01	-.32***
E+ Adaptive	.04	-.01	.08	.05
E+ Maladaptive	.08	-.06	.04	-.04
E- Adaptive	-.03	-.01	-.01	.00
E- Maladaptive	-.06	-.03	-.02	-.01
A+ Adaptive	-.06	-.22*	.01	-.15
A+ Maladaptive	-.08	-.29**	.00	-.12
A- Adaptive	-.02	.29**	-.06	.18
A- Maladaptive	.06	.27**	.03	.17
N+ Maladaptive	-.31***	-.11	-.21*	-.14
N- Adaptive	.13	-.04	-.01	-.09

*Note: N = 73; * p<0.1 light grey shaded; ** p<0.05 dark grey shaded; *** p<0.01 dark grey shaded.*

Table 6-14: Raw Correlations of BF57 with Leadership Competencies continued

	Integrity & Trust	Inter-personally Astute	Coaches & Develops Others	Win-Win Partnering
O+ Adaptive	.04	.02	.06	.06
O+ Maladaptive	.00	-.05	-.03	.02
O- Adaptive	-.16	-.11	-.20*	-.16
O- Maladaptive	-.09	-.06	-.09	-.13
C+ Adaptive	-.11	-.02	-.05	-.05
C+ Maladaptive	-.17	-.07	-.11	-.08
C- Adaptive	.02	-.06	-.03	-.03
C- Maladaptive	.04	.00	.03	.01
E+ Adaptive	-.08	-.04	.07	-.01
E+ Maladaptive	-.14	-.06	.01	-.03
E- Adaptive	.10	.12	.05	.09
E- Maladaptive	.10	.15	.05	.16
A+ Adaptive	.05	.16	.08	.17
A+ Maladaptive	.01	.06	.06	.05
A- Adaptive	-.13	-.16	-.01	-.14
A- Maladaptive	-.08	-.15	-.05	-.18
N+ Maladaptive	-.24**	-.14	-.13	-.12
N- Adaptive	-.02	-.12	-.02	-.08

*Note: N = 73; * p<0.1 light grey shaded; ** p<0.05 dark grey shaded; *** p<0.01 dark grey shaded.*

Table 6-14: Raw Correlations of BF57 with Leadership Competencies continued

	Purposeful Argumentation	Provides Clear Directives	Strives for Excellence	Drive & Determination
O+ Adaptive	.16	-.02	.23**	.04
O+ Maladaptive	.04	-.09	.10	-.04
O- Adaptive	-.24**	-.10	-.31***	-.14
O- Maladaptive	-.15	-.04	-.21*	-.07
C+ Adaptive	.01	.07	-.11	.05
C+ Maladaptive	-.09	.02	-.16	.04
C- Adaptive	-.18	-.16	.01	-.14
C- Maladaptive	-.19*	-.21*	.05	-.08
E+ Adaptive	.28**	.03	.09	.11
E+ Maladaptive	.22**	.01	.10	.14
E- Adaptive	-.24**	-.03	-.07	-.09
E- Maladaptive	-.25**	-.03	-.04	-.02
A+ Adaptive	-.31***	-.17	-.11	-.07
A+ Maladaptive	-.32***	-.18	-.09	-.06
A- Adaptive	.34***	.18	.07	.04
A- Maladaptive	.24**	.12	.06	.04
N+ Maladaptive	-.16	-.13	-.10	-.05
N- Adaptive	.05	-.04	-.01	-.12

*Note: N = 73; * p<0.1 light grey shaded; ** p<0.05 dark grey shaded; *** p<0.01 dark grey shaded.*

Table 6-14: Raw Correlations of BF57 with Leadership Competencies continued

	Leading With Vision	Leading to Deliver	Leading Through People	Leading With Drive
O+ Adaptive	.26**	-.06	.05	.11
O+ Maladaptive	.16	-.13	-.02	.00
O- Adaptive	-.28**	-.05	-.17	-.22*
O- Maladaptive	-.24**	-.03	-.10	-.13
C+ Adaptive	-.06	.10	-.07	.00
C+ Maladaptive	-.16	.02	-.11	-.06
C- Adaptive	.01	-.19*	-.02	-.13
C- Maladaptive	-.05	-.25**	.02	-.12
E+ Adaptive	.18	.05	-.02	.14
E+ Maladaptive	.13	.01	-.06	.14
E- Adaptive	-.08	-.02	.10	-.12
E- Maladaptive	-.05	-.04	.12	-.10
A+ Adaptive	-.01	-.13	.12	-.18
A+ Maladaptive	-.09	-.15	.05	-.18
A- Adaptive	.04	.11	-.11	.18
A- Maladaptive	.03	.16	-.12	.13
N+ Maladaptive	-.21*	-.23*	-.17	-.12
N- Adaptive	.02	.00	-.07	-.03

*Note: N = 73; * p<0.1 light grey shaded; ** p<0.05 dark grey shaded; *** p<0.01 dark grey shaded.*

6.6 Study Three Discussion

Table 6-15: Summary of Study Three Hypotheses

Hypothesis	Outcome
H19: "Analysing Situations" will correlate positively with at least one of the positive Openness scales, or negatively with at least one of the negative Openness scales	Not Supported
H20: "Creating Concepts" will correlate positively with at least one of the positive Openness scales, or negatively with at least one of the negative Openness scales	Supported
H21: "Relating to People" will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales	Supported
H22: "Controlling Resources" will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales	Not Supported
H23: "Respecting People" will correlate positively with at least one of the positive Agreeableness scales, or negatively with at least one of the negative Agreeableness scales	Supported
H24: "Adapting to Demands" will correlate negatively with the positive Neuroticism scale, or negatively with the positive Neuroticism scale	Supported
H25: "Delivering Results" will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales	Supported
H26: "Driving Performance" will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales	Supported
H27: "Sum of All Eight" will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales	Supported
H28: "Sum of All Eight" will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales	Supported
H29: "Sum of All Eight" will correlate positively with the negative Neuroticism scale, or negatively with the positive Neuroticism scale	Supported

Table 6-15: Summary of Study Three Hypotheses continued

Hypothesis	Outcome
H30: It was hypothesized that for the point to point a priori assumed BF57 dimension to Great Eight competency correlations detailed in section 6.1.2.1, the adaptive scales would consistently correlate more highly with the Great Eight competency criterion than the maladaptive scales. This yields a total of 14 possible shifts in correlation coefficients.	Supported
H31: It was hypothesized across the 64 possibilities, a statistically greater than chance number would show a statistically significant difference in the correlation coefficients between the adaptive and maladaptive scales.	Supported
H32: Within each Big Five dimension a regression of the 4 scales for O, C, E and A, and of the 2 scales for N, will produce a stronger relationship (as measured by the multiple correlation coefficient) than for the same items in the BF57 used to create 1 measure of O, C, E, A and N. It is hypothesized that this will be the case for the eight competencies in the Great Eight model.	Supported

Study Three presents much evidence in favour of the criterion validity of the BF57. In line with expectations, it has also been shown that maladaptive scales generally have a more negative impact on performance that adaptive scales.

Nevertheless, some maladaptive scales do still have a positive correlation with some behavioural competencies. This is consistent with Hogan and Hogan's (1997) research on dark side traits and their impact on work.

Good evidence is found to support the differential relationship between BF57 adaptive and maladaptive scales and performance at work.

Further research is required here to build on Grant's (2013) call for more modelling of curvilinear relationships. Grant (2013) found sales people achieved more sales if they were more extraverted up to a certain point, but then too much Extraversion started to block performance. Such phenomenon can now be explored with the BF57 to establish if it is maladaptive Extraversion that causes the performance issue and to find out if adaptive Extraversion by itself does not have a curvilinear relationship with performance. Equally, the impact of maladaptive Introversion on sales performance can be explored with more fidelity with the BF57.

7 STUDY FOUR: RE-VALIDATING THE BF57 WITH A SECOND SAMPLE

7.1 Introduction

7.1.1 Study Four Objectives

A second sample of data based on participants completing the BF57 was gathered. The purpose was to re-validate the Big Five factor structure, as well as the eighteen scales firstly in terms of test-retest reliability, and secondly in terms of the underlying factor structure.

7.2 Method

7.2.1 The Context for Study Four

When creating a shorter questionnaire, it is possible to choose just the best performing items based on item to total correlations and factor analysis. An example of such an instrument where such an approach was used would be the TDA instrument used in study two of this thesis. Goldberg (1992) selected the 100 adjectives from a larger pool of adjectives based on striving for simple structure and factor pure dimensions. This typically will simultaneously ensure a reliable set of scales are produced, as measured by Cronbach's Alpha.

However, in creating the BF57 a slightly different approach was adopted. Item to total correlations were used, but were not used singularly to optimise the factor structure or reliability. Study One outlined the approach that gave significant weighting to content validity in order to ensure the five domains had maximum bandwidth for the given relatively low number of items, and to mitigate any risk of the scales becoming "bloated specifics". This heightens the need to measure other forms of reliability such as a test-retest analysis. Consequently, a test–retest analysis is particularly helpful for shorter questionnaires such as the BF57 which only has 3 or 4 items per scale and so limits the result that can be achieved with Cronbach's Alpha reliability measures.

7.2.2 Materials and Procedures

A copy of the questionnaire can be found in Appendix III: BF57 Items by Aspect. Data was extracted into Microsoft Excel by means of the online package Survey Gizmo (www.surveygizmo.com/). Data was then imported from Excel into SPSS version 23 for subsequent analysis.

7.2.3 Questionnaire Response Format

The exact same process and questionnaire structure was used as in Study One, however, the number of questions was cut down to the selected fifty-seven items. Data was matched with study one via each participant providing their full name. As with study one, the data was then anonymised before the analysis was undertaken. The volunteers filled in the questionnaires at times most convenient to them in a six-week window.

The BF57 questionnaire used a five-point Likert scale. The items and their scores for all participants were downloaded from the online survey package used and then analysed in SPSS version 23.

7.2.4 Participants and Design

Those of the 2,506 who had previously indicated they would be willing to support further research were emailed and invited to support the new study. A further convenience sample of respondents were recruited from a similar variety of organisations as used in study one. This included government and commercial organisations, the majority being in the UK, US, Canada, Mexico, Australia, South Africa, Germany, France and Belgium. Contact was typically made though their HR (human resources) departments and potential respondents were forwarded on-line links to the BF57 either by their HR departments or through a direct email link sent by the author with an invitation to participate. Respondents who completed the questionnaire were given an invitation to attend one of a number of webinars (online web seminar) and anyone wishing to discuss their results on a one to one basis were offered the opportunity to do so. 438 people responded to these invitations and completed the questionnaire (N = 283 females, mean age = 48.0, SD = 11.9; N = 155 males, mean age = 50.4, SD = 14.2).

7.2.5 Research Questions and Hypotheses

RQ1: Is the proposed BF57 model of personality compatible with the Big Five factor structure?

It was hypothesised that:

H33: The Big Five factor structure would be present in the second sample

H34: The simple structure achieved in Table 4-7 in study one will be replicated

H35: The test-retest reliabilities for the eighteen scales will all exceed 0.6 given that the Cronbach's Alpha scores in study one were all above 0.61

H35: The test-retest reliabilities for the five Big Five dimensions will all exceed 0.75 given that the Cronbach's Alpha scores in study one were all above 0.79

7.2.6 Analysis

A further exploration of the factor structure on the new data was undertaken with N = 438 participants, using exploratory factor analysis and parallel analysis. The Cronbach's Alpha statistic was also re-evaluated, and a test-retest analysis undertaken based on those people in this sample who had also completed the questionnaire in study one. 195 of the 438 had done study one, and 243 were new participants. The second test was assessed two years seven months after the initial assessment. Due to the reduced sample size of the second study, it was not possible to repeat the confirmatory factor analysis undertaken in study one.

7.3 Results

7.3.1 Test-retest Reliability

The test-retest reliabilities for the eighteen BF57 scales and the Big Five dimensions derived from the BF57 are shown in Table 7-1 below. The mean test-retest reliability for the eighteen scales was 0.73 and at the level of the Big Five dimensions was 0.84. All correlations were highly significant ($p<0.0005$).

Table 7-1: Test-retest Reliability of the BF57

	Mean Time 1	Mean Time 2	t (df = 194), p	Significant change	R
O+ Adaptive	10.54	10.34	1.47, p=0.14		0.69
O+ Maladaptive	8.16	8.11	0.35, p=0.73		0.74
O- Adaptive	7.27	7.49	-1.97, p=0.05	Increase	0.76
O- Maladaptive	6.56	6.38	1.53, p=0.13		0.74
Openness	4.87	4.57	0.89, p=0.38		0.84
C+ Adaptive	10.13	10.45	-2.32, p=0.02	Increase	0.75
C+ Maladaptive	7.88	8.17	-2.11, p=0.04	Increase	0.67
C- Adaptive	9.08	8.92	1.06, p=0.29		0.63
C- Maladaptive	7.53	7.15	2.90, p=0.004	Decrease	0.78
Conscientiousness	1.4	2.56	-4.01, p<0.0005	Increase	0.87
E+ Adaptive	10.74	10.6	1.23, p=0.22		0.81
E+ Maladaptive	8.29	8.31	-0.11, p=0.19		0.72
E- Adaptive	8.68	8.58	0.74, p=0.46		0.83
E- Maladaptive	7.72	7.45	2.09, p=0.04	Decrease	0.76
Extraversion	2.64	2.88	-0.73, p=0.47		0.88
A+ Adaptive	10.69	10.6	0.74, p=0.46		0.71
A+ Maladaptive	9.18	8.74	2.86, p=0.005	Decrease	0.69
A- Adaptive	12.24	11.61	3.82, p<0.0005	Decrease	0.67
A- Maladaptive	7.43	7.98	-3.47, p<0.0005	Increase	0.70
Agreeableness	0.25	-0.25	1.20, p=0.23		0.82
N+ Maladaptive	9.07	9.76	-3.91, p<0.0005	Increase	0.76
N- Adaptive	15.17	15.47	-2.04, p=0.04	Increase	0.69
Neuroticism	-6.1	-5.71	-1.57, p=0.12		0.80

Note: N = 195

These results suggest a good deal of stability in the BF57's Big Five dimensions and the eighteen lower level scales. All measures exhibited high levels of reliability. At the level of the Big Five dimensions only Conscientiousness showed a significant change (an increase) over the period of the study. Within this, the adaptive Conscientious (C+ Ada) and maladaptive Conscientious (C+ Mal) both increased significantly while the maladaptive Flexible (C- Mal) decreased significantly.

Overall eight of the eighteen measures exhibited no significant change over the study. In addition to the changes in Conscientiousness, the adaptive Direct (A- Ada) and maladaptive Agreeableness (A+ Mal) measures showed a significant decrease, while the maladaptive negative aspect of it increased significantly. The maladaptive Introversion (E- Mal) also increased significantly; and both the maladaptive Neurotic and adaptive Emotional Stability increased significantly. Finally, the adaptive Pragmatic (O- Ada) aspect of Openness also exhibited a significant increase.

7.3.2 Exploratory Factor Analysis Time 2

A parallel analysis was undertaken to assess if the five-factor structure was still present in the follow up data. With a much smaller data set for the follow up (N = 438) only 100 data sets were randomly produced for the simulation. From the analysis five factors from the Principal Component Analysis were found to have eigenvalues greater than those produced from the simulated data at the 95th percentile (see Table 7-2 below). Data from the first six roots are shown in the table below. These five factors accounted for 79.3% of the variance. Sampling adequacy for the analysis was high; KMO = 0.783.

The rotated (varimax) factor structure is shown in Table 7-3.

Table 7-2: Results of Parallel Analysis

Root	Raw Data	Means	95th Percentile
1	4.777	1.373	1.449
2	2.848	1.200	1.342
3	2.185	1.245	1.289
4	2.025	1.999	1.242
5	1.435	1.151	1.187
6	1.005	1.115	1.141

Note: N = 438, Ndata sets = 100, variables = 18.

Table 7-3: Factor Structure Time Two Data

	F1	F2	F3	F4	F5
O+ Adaptive	-0.72			0.42	
O+ Maladaptive	-0.44		0.46	0.55	
O- Adaptive	0.71				
O- Maladaptive	0.72				
C+ Adaptive			-0.83		
C+ Maladaptive	0.52		-0.49		
C- Adaptive			0.66		
C- Maladaptive			0.85		
E+ Adaptive		-0.82			
E+ Maladaptive		-0.69		0.53	
E- Adaptive		0.90			
E- Maladaptive		0.87			
A+ Adaptive					0.84
A+ Maladaptive					0.72
A- Adaptive				0.70	
A- Maladaptive				0.81	
N+ Maladaptive	0.67				
N- Adaptive	-0.67				

Notes: N = 438. Varimax Rotation. Loadings >0.40 shown.

At the time of writing the size of the follow up data set precludes an appropriate attempted replication of the factor structure found in the confirmatory factor analysis carried out in the earlier study. However, an indication of the stability of the initial factor structure can be obtained by examining the data from the 195 people who provided information at both time points. For this sub-sample factor scores for the

first five factors derived at each time point were correlated. Results are shown in Table 7-4.

Table 7-4: Correlations between factor scores at time one and time two

	Time 2 Factor 1	Time 2 Factor 2	Time 2 Factor 3	Time 2 Factor 4	Time 2 Factor 5
Time 1 Factor 1	0.87**				
Time 1 Factor 2			-0.80**		
Time 1 Factor 3		0.65**			
Time 1 Factor 4				-0.82**	
Time 1 Factor 5		-0.26**			0.64**

Note: N = 195. Significant correlations, p<0.01 only shown

The strong correlations observed here between comparable factors over the two-year time period are suggestive of a stable factor structure, although the relative strengths of these factors in terms of explained variance may be different. Ongoing further research will enable this question to be answered with more clarity.

7.4 Study Four Discussion

Table 7-5: Summary of Study Four Hypotheses

Hypothesis	**Outcome**
H33: the Big Five factor structure would be present in the second sample	Supported
H34: the simple structure achieved in Table 4-5 in study one will be replicated	Not Supported
H35: the test-retest reliabilities for the eighteen scales will all exceed 0.6 given that the Cronbach's Alpha scores in study one were all above 0.61	Supported
H35: the test-retest reliabilities for the five Big Five dimensions will all exceed 0.75 given that the Cronbach's Alpha scores in study one were all above 0.79	Supported

It was hypothesised that the Big Five factor structure would be present in the second sample and this has been confirmed in Table 7-2: Results of Parallel Analysis.

It was hypothesised that the simple structure achieved in Table 4-7 in study one would be replicated and Table 7-3 shows this has not been achieved. That said,

Table 7-3 does suggest an Extraversion factor in F2. It also suggests a Conscientiousness factor in F3.

However, Agreeableness appears to be split over F4 and F5 in this second sample. The direct (or disagreeable) A- Ada and A- Mal scales load on F4, along with some Extraversion and Openness, possibly suggesting a Digman (1997) Beta higher order factor. The agreeable and people pleasing A+ Ada and A+ Mal scales loaded onto F5.

One difference with study one was that Neuroticism (N+ Mal) and Pragmatic (O- Ada and O- Mal) loaded positively onto F1, with Emotional Stability and Openness (O+ Ada and O+ Mal) forming the other polarity. Although this structure is not evident in the exploratory factor analysis in Table 4-7 in study one, there is evidence of it in Table 4-8: Standardised regression coefficients for Five Factor model of personality – with factors correlated. Factor three in this CFA had coefficients of 0.35 for O- Adaptive and 0.42 O- Maladaptive, with the N+ Maladaptive and N- Maladaptive coefficients being 0.78 and -0.59 respectively. This combined with the correlations between the factors in Table 7-4 would overall suggest the hypothesis is partially supported.

It was hypothesized that the test-retest reliabilities for the eighteen scales will all exceed 0.6 and Table 7-1 offers strong support for this, with then lowest across all eighteen being 0.63. Given the small number of items per scale in the BF57, this is an important result.

Finally, it was hypothesized that the test-retest reliabilities for the five Big Five dimensions will all exceed 0.75 and Table 7-1 also provides strong support for this, with then lowest across all five dimensions being 0.80. The test-retest results at the eighteen-scale level and the Big Five level are more impressive when considering the two-year seven-month gap which typically would cause some further deterioration in test-retest scores compared to a three-month period.

One possible limitation of this study may be that the 195 participants that did the BF57 again were a self-selecting sample from a much bigger sample. Another test-retest on a fully fresh new sample over a three-month period is clearly desirable.

8 STUDY FIVE: CONSENSUAL VALIDITY OF THE BF57

8.1 Introduction

8.1.1 Study Five Objectives

A second sample of data based on participants inviting colleagues to provide them with BF57 based 360 feedbacks was gathered. The purpose was to assess the consensual validity of the BF57 at the Big Five level as well as at the level of the eighteen scales.

8.1.2 Consensual Validity

Consensual validity (McCrae, 1982) is an important way of understanding the BF57's psychometric properties. It involves correlating the scores for the self-assessed scales and dimensions with the equivalent external assessor ratings. Convergent and divergent validity can then be further assessed. The external assessors need to know the assessee well enough for this procedure to be effective (Norman & Goldberg, 1966). External assessors observe specific behaviours and from these infer dispositional traits, which are compared with the assessee's private thoughts, feelings and behaviours more directly assessed as traits. One advantage of consensual validity, as outlined by McCrae and Costa (1983), is that it mitigates some of the subjective and distorting aspects of self-reports such as socially desirable responding, not disclosing traits that may be seen as negative and acquiescing responses. However, external assessors can be subject to different biases too such as stereotyping people positively or negatively. They also bring their own filters and personal biases to the assessment of others' traits. For example, some biases may stem from the observer's own level of the trait being measured and/or their self-esteem. If, despite these self-assessed and external-assessed differences, there is still a consensus between the two assessments of the same person, this would be a powerful form of additional validity evidence in favour of the BF57.

Mischel (1968) suggested convergent validities need to exceed the 0.3 barrier. Gomà-i-Freixanet, Wismeijer and Valero (2005) also use this standard when

assessing consensual validity and it was decided this was a helpful standard to adopt for the hypotheses tested in this study.

8.1.3 Research Question and Consensual Validity Hypotheses

RQ1: Is the proposed BF57 model of personality compatible with the Big Five factor structure?

It was hypothesised that:

H36: The average BF57 Big Five dimensions self vs 360-rater correlation will exceed 0.3

H37: The average BF57 eighteen scales self vs 360-rater correlation will exceed 0.3

H38: The average BF57 fifty-seven item level self vs 360-rater correlation will exceed 0.3

8.2 Method

8.2.1 Materials and Procedures

8.2.1.1 Creating the External Assessor Version

McCrea and Costa (1983) advocated using the identical instrument for self-assessment and external assessment and following the procedure outlined by them (p. 249) the BF57 items were converted from the first person (“I prefer …”) to the third person (“They prefer …”). For example, the adaptive A- item “I am firm and direct with others” was converted to “They are firm and direct with others”. In so doing, the rest of the item was always kept the same. The items used by the external assessors are detailed in Appendix VI: BF57 Observer Items by Aspect.

8.2.1.2 Inviting feedback

Norman and Goldberg (1966) highlighted the importance of the external assessor knowing the assessee well and highlighted a statistical risk if this is not the case stating “if the raters believed that a certain trait is highly related to some other trait in the set (and if they were able to recall their nominations on such a scale earlier in

the series), then those raters who “by chance” were nominated at the extremes on the former scale would also be placed at the corresponding extreme of the latter. That is that the conceptualisation of trait structure shared by the raters could be sufficient to generate a correlational pattern and factor structure of the sort recurrently obtained previously in these sorts of studies” (p. 682). To avoid the risk of these spurious statistical features, when participants were invited to select a rater to give them feedback, the need for the rater to know them well was emphasised. Raters could be partners, family, friends or colleagues.

8.2.1.3 Questionnaire Response Format

The exact same online process and questionnaire structure was used as in Study Four, however, the questions were of a 360 third person nature and the instructions modified accordingly. The external rater did not provide their name, but did input the name of the person they were assessing. Both self and 360 instruments used the same 5-point Likert format, with response ranging from ‘strongly agree’ to ‘strongly disagree’. Data was extracted into Microsoft Excel by means of the online package Survey Gizmo (www.surveygizmo.com/). Data was then imported from Excel into SPSS version 23 for subsequent analysis. Data was matched with study one via each participant providing their full name. As with previous studies, the data was then anonymised before the analysis was undertaken. The raters filled in the questionnaires at times most convenient to them in a six-week window. The BF57 rater questionnaire used a five-point Likert scale.

8.2.2 Participants and Design

Those of the 2,506 who had previously indicated they would be willing to support further research were emailed and asked if they would like to nominate somebody to give them observer feedback. It was suggested that typically the best observers included colleagues at work that knew them well, partners, relatives and close friends. This introductory email detailed the purpose of the study and provided them with a URL link to forward on to potential raters.

Once a potential rater clicked on the URL link, their informed consent was sought, the study purpose outlined and they were enrolled into giving feedback. If they had any questions they could contact the author.

Observers who completed an assessment were given an invitation to attend one of a number of webinars (online web seminar) if they were interested to know more about the research. Anyone wishing to discuss the process or their experience on a one to one basis were offered the opportunity to do so. 117 raters responded to these invitations and completed the observer questionnaire (N = 71 females, mean age = 52.7, SD = 11.6; N = 46 males, mean age = 56.0, SD = 12.7).

8.2.3 Analysis

The consensual validity was determined by comparing the self-assessed and external-rater-assessed eighteen scales and five dimensions.

Correlation coefficients assessed the extent of alignment of the eighteen scales and five dimensions of the BF57 between self-assessors and external-raters. The assumption was made, that if the BF57 measures are valid, then the validity diagonal coefficients should be larger than any other coefficient in the same row or column. That is to say, the diagonal is a measure of the correlation between the same scales with data collected via two different methods.

The moderate sample size (N = 117) made it inappropriate to undertake an exploratory factor analysis. However, further research recommends a larger sample size is gathered as McCrae and Costa (1983) have demonstrated how a joint factor approach can establish if a hypothesized structure is consistent across external assessments and self-assessments. Confirmatory factor analysis could also be used to test hypotheses about the equivalence of structure of the two data sets.

8.3 Results

Table 8-1 (five-dimension level) and Table 8-2 (eighteen-scale level) each display a multitrait-multimethod matrix with the hetero-method correlations (uncorrected) between the self BF57 assessment and 360 BF57 assessment being displayed as diagonals. This diagonal is highlighted in green and forms the convergent validity coefficients for this analysis. For ease of interpretation, Table 8-3 shows just the convergent validity diagonal from Table 8-2.

These tables do indicate a clear convergent and discriminant pattern, in line with expectations. Table 8-1 shows for convergent validity, all five dimensions displayed a significant level of rater-ratee agreement. The convergent correlations in the diagonal ranged from 0.44 to 0.65 (absolute mean inter-dimension correlation = 0.54).

Table 8-2 shows for convergent validity, all eighteen scales displayed a significant level of rater-ratee agreement. The convergent correlations in the diagonal ranged from 0.27 to 0.57 (absolute mean inter-scale correlation = 0.42).

Campbell and Fiske (1959) suggested convergent correlations in the form of the diagonal, should exceed the off-diagonal correlations. Furthermore, any diagonal correlations should exceed the other correlations in the same row or column. Based on this criterion, the data suggests the five dimensions and eighteen scales both display good discriminant validity.

For completeness, the correlation between the self-assessed items and the externally-rated items have been computed and are displayed in the final right hand column of Table 11-18, Table 11-19, Table 11-20, Table 11-21and Table 11-22 detailed in Appendix VI: BF57 Observer Items by Aspect. The highest item level correlation was for the adaptive Introverted item “They are naturally more quiet and introspective” with r = 0.61. The lowest item level correlation was for the maladaptive low Openness item “They can lack the imagination to see wider possibilities” with r = 0.17. Across all fifty-seven items, the average self-360 correlation at the item level had r = 0.32.

All three-hypothesis outlined in section 8.1.3 were supported by the results. This combined with the other results presented in study five offer support for the construct validity of the BF57 at the Big Five, eighteen scale and fifty-seven item levels.

Table 8-1: Multitrait-Multimethod Matrix for Big Five BF57 Self and 360 Observer Data

	Self BF57 O	Self BF57 C	Self BF57 E	Self BF57 A	Self BF57 N
360 BF57 O	-.53**	-.40**	.42**	-.29**	-.10
360 BF57 C	-.48**	-.57**	-.29**	.03	.04
360 BF57 E	.26**	-.20*	-.65**	-.27**	-.04
360 BF57 A	-.09	-.17	-.16	-.52**	.01
360 BF57 N	-.09	.06	-.14	.15	-.44**

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Convergent correlations are the diagonal.*

Table 8-2: Multitrait-Multimethod Matrix for Eighteen Scale BF57 Self and 360 Observer data

	360 O+ Ada	360 O+ Mal	360 O- Ada	360 O- Mal	360 C+ Ada	360 C+ Mal	360 C- Ada	360 C- Mal
Self O+ Adaptive	.49**	.38**	-.34**	-.30**	-.36**	-.37**	.38**	.39**
Self O+ Maladaptive	.44**	.31**	-.24**	-.26**	-.43**	-.25**	.33**	.36**
Self O- Adaptive	-.50**	-.44**	.39**	.29**	.35**	.30**	-.38**	-.39**
Self O- Maladaptive	-.40**	-.33**	.36**	.27**	.26**	.32**	-.31**	-.33**
Self C+ Adaptive	-.45**	-.25**	.33**	.27**	.51**	.42**	-.34**	-.40**
Self C+ Maladaptive	-.39**	-.22*	.26**	.27**	.48**	.41**	-.36**	-.42**
Self C- Adaptive	.30**	.16	-.22*	-.18*	-.42**	-.34**	.40**	.40**
Self C- Maladaptive	.31**	.24*	-.22*	-.17	-.52**	-.38**	.38**	.44**
Self E+ Adaptive	.31**	.23*	-.30**	-.33**	-.20*	-.27**	.19*	.24*
Self E+ Maladaptive	.33**	.28**	-.26**	-.28**	-.35**	-.35**	.27**	.30**
Self E- Adaptive	-.28**	-.28**	.32**	.28**	.17	.22*	-.17	-.18
Self E- Maladaptive	-.30**	-.30**	.29**	.25**	.14	.17	-.12	-.18*
Self A+ Adaptive	-.22*	-.19*	.15	.16	.05	.02	-.03	.01
Self A+ Maladaptive	-.21*	-.25**	.23*	.20*	.02	.10	-.03	.00
Self A- Adaptive	.08	.24**	-.08	-.01	.05	.05	-.08	-.06
Self A- Maladaptive	.24**	.29**	-.14	-.07	-.10	-.09	.09	.03
Self N+ Maladaptive	-.05	-.06	.09	.08	-.09	.13	-.06	.06
Self N- Adaptive	.13	.10	-.08	-.02	.05	-.15	.12	.03

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Convergent correlations are the diagonal.*

Table 8-2: Multitrait-Multimethod Matrix for Eighteen Scale BF57 Self and 360 Observer continued

	360 E+ Ada	360 E+ Mal	360 E- Ada	360 E- Mal	360 A+ Ada	360 A+ Mal	360 A- Ada	360 A- Mal	360 N+ Mal	360 N- Ada
Self O+ Adaptive	.23*	.20*	-.19*	-.11	.00	.05	.05	.09	-.05	.12
Self O+ Maladaptive	.03	.15	-.05	-.06	-.17	-.01	.05	.05	-.06	.01
Self O- Adaptive	-.26**	-.32**	.21*	.23*	.06	.06	-.18	-.13	.06	-.06
Self O- Maladaptive	-.28**	-.27**	.21*	.20*	-.05	.03	-.07	-.11	.08	-.15
Self C+ Adaptive	-.20*	-.10	.11	.19*	-.09	-.04	.11	.14	.07	.04
Self C+ Maladaptive	-.24**	-.20*	.16	.26**	-.10	-.08	.03	.08	.12	-.11
Self C- Adaptive	.17	.04	-.05	-.12	.16	.20*	-.16	-.15	.00	.03
Self C- Maladaptive	.15	.08	-.08	-.14	.09	.12	-.16	-.17	-.07	.01
Self E+ Adaptive	.57**	.41**	-.47**	-.45**	.09	-.09	.16	.13	-.16	.25**
Self E+ Maladaptive	.40**	.47**	-.40**	-.37**	-.03	-.11	.22*	.22*	-.06	-.01
Self E- Adaptive	-.61**	-.49**	.57**	.56**	-.09	.12	-.26**	-.22*	.11	-.15
Self E- Maladaptive	-.54**	-.39**	.41**	.47**	-.09	.06	-.14	-.14	.06	-.14
Self A+ Adaptive	.05	-.13	-.02	-.03	.23*	.18*	-.29**	-.21*	.13	-.01
Self A+ Maladaptive	-.31**	-.37**	.27**	.20*	.18	.32**	-.44**	-.30**	.17	-.09
Self A- Adaptive	.15	.37**	-.27**	-.12	-.27**	-.31**	.50**	.43**	-.08	-.03
Self A- Maladaptive	.07	.30**	-.12	-.05	-.40**	-.31**	.44**	.41**	-.26**	.02
Self N+ Maladaptive	-.17	-.01	.11	.11	.03	.08	-.13	-.02	.37**	-.46**
Self N- Adaptive	.03	-.07	.09	.09	.08	.08	-.01	-.11	-.21*	.45**

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Convergent correlations are the diagonal.*

Table 8-3: Eighteen Scales of BF57 Self and 360 Observer Correlational Diagonal

	Convergent Correlations (Diagonal from Table 8-2)
BF57 Self & 360 O+ Adaptive	.49**
BF57 Self & 360 O+ Maladaptive	.31**
BF57 Self & 360 O- Adaptive	.39**
BF57 Self & 360 O- Maladaptive	.27**
BF57 Self & 360 C+ Adaptive	.51**
BF57 Self & 360 C+ Maladaptive	.41**
BF57 Self & 360 C- Adaptive	.40**
BF57 Self & 360 C- Maladaptive	.44**
BF57 Self & 360 E+ Adaptive	.57**
BF57 Self & 360 E+ Maladaptive	.47**
BF57 Self & 360 E- Adaptive	.57**
BF57 Self & 360 E- Maladaptive	.47**
BF57 Self & 360 A+ Adaptive	.23*
BF57 Self & 360 A+ Maladaptive	.33**
BF57 Self & 360 A- Adaptive	.50**
BF57 Self & 360 A- Maladaptive	.41**
BF57 Self & 360 N+ Maladaptive	.37**
BF57 Self & 360 N- Adaptive	.45**

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Convergent correlations are the diagonal.*

8.4 Study Five Discussion

Table 8-4: Summary of Study Five Hypotheses

Hypothesis	**Outcome**
H36: the average BF57 Big Five dimensions self vs 360-rater correlation will exceed 0.3	Supported
H37: the average BF57 eighteen scales self vs 360-rater correlation will exceed 0.3	Supported
H38: the average BF57 fifty-seven item level self vs 360-rater correlation will exceed 0.3	Supported

The study set out to gather data based on 360 observer feedback using a version of the BF57 items for raters. The intention was to review the consensual validity of the BF57.

All of the hypotheses established at the start of the research have been supported in that, the average consensual validities all are above the 0.3 required standard. In particular, the average BF57 Big Five dimensions self vs 360-rater correlation was 0.54, for the eighteen-scale equivalent it was 0.42 and for the fifty-seven items it was 0.32.

These results are consistent with other researchers. For example, Gomà-i-Freixanet, Wismeijer and Valero (2005) in a 360 study using the Zuckerman–Kuhlman personality questionnaire found consensual validity ranging from 0.47 to 0.63, with an absolute mean inter-scale correlation of 0.56.

A visual inspection of the item level consensual validities does help explain some of the spread in correlations. It seems that traits that are close to or are actual behaviours, are easier for raters to estimate and the correlations are higher. For example, “They naturally see things through to completion” has r = 0.43** and “They are a highly organised individual” has r = 0.45** and these are clearly observable behaviours. Lower scores, such as “Their empathy for others can cloud their judgement” has r = 0.17 and it is plausible that a 360 rater may not have access to know how empathetic another person feels, unless they know them very well.

It is also notable, that the maladaptive scales generally have lower consensual validities than the adaptive scales. This may be because 360 raters may be reluctant to provide what they see as “negative feedback” on another person.

Nevertheless, study five does offer good evidence of the consensual validity of the BF57.

8.5 Limitations of the Study and Further Research

A sample size on N = 117 is adequate, as evidenced by the fact that the correlation coefficients measured on the diagonals for convergent validity all had statistical significance at the 0.01 level (2-tailed) for the eighteen scales and five Big Five

measures. However, a greater sample size would have enabled segmenting the data by gender and other demographics and without this it is difficult to undertake any more sophisticated analysis.

Study five has focused on consensual validity. A future research study could achieve a greater sample size and then examine whether BF57 observer ratings can explain performance, such as that measured by the Great Eight, over and above that accounted for by BF57 self-ratings.

The self-assessed and observer assessed sample size was not high enough to enable the differential validity of different feedback types to be explored e.g. work colleague 360 validity versus spouse 360 validity. Equally, an analysis of consensual validity split by gender may prove fruitful if enough statistical power can be provided through a larger sample size.

9 STUDY SIX: EVALUATIVE BIAS OF THE TDA, IPIP-NEO AND BF57

9.1 Introduction

The purpose of this study was to quantify the evaluative bias present in the TDA, IPIP-NEO and BF57 and test hypotheses related to the differences between the three questionnaires. To achieve this objective, participants scored the instruments' items not on how they saw themselves, but on how socially desirable they thought the items were.

RQ9: Can the BF57 reduce the impact of evaluative bias in the Big Five?

It was hypothesised that:

H39: The TDA and IPIP-NEO measure of Openness will possess more evaluative bias than the BF57 measure of Openness

H40: The TDA and IPIP-NEO measure of Conscientiousness will possess more evaluative bias than the BF57 measure of Conscientiousness

H41: The TDA and IPIP-NEO measure of Extraversion will possess more evaluative bias than the BF57 measure of Extraversion

H42: The TDA and IPIP-NEO measure of Agreeableness will possess more evaluative bias than the BF57 measure of Agreeableness

9.2 Method

9.2.1 Materials and Procedures

The procedure to measure social desirability set out by Bäckström et al. (2014) was followed for study six. Three new questionnaires were created to measure evaluative bias, based on the exact same items used in the TDA, IPIP-NEO and BF57 instruments used in the earlier studies of this thesis.

The exact same online process and questionnaire structure was used as in study five, however, as the questions were not assessing an individual's traits per se, but

instead inviting them to assess how socially desirable they think the traits are, new instructions above the items were created as shown below:

"Please score each of these statements according to how socially desirable you think they would be in another person. Do not consider whether you yourself possess them or not. Instead, just intuitively rate them based on how much you think others may find them desirable."

All three instruments were scored using a 5-point Likert format, with responses ranging from 'Highly Desirable' to 'Highly Undesirable'. Data was extracted into Microsoft Excel by means of the online package Survey Gizmo (www.surveygizmo.com/). Data was then imported from Excel into SPSS version 23 for subsequent analysis.

As with previous studies, the data was then anonymised before the analysis was undertaken. The volunteers filled in the questionnaires at times most convenient to them in a two-week window.

9.2.2 Participants and Design

Those of the 2,506 who had previously indicated they would be willing to support further research were emailed and asked if they would like to support a study on social desirability.

This introductory email detailed the purpose of the study and provided them with a URL link to enter the questionnaire.

Once a potential participant clicked on the URL link, their informed consent was sought and the study purpose re-iterated. If they had any questions they could contact the author. Some participants did contact the author to double check they were not being invited to assess themselves and this was helpful in ensuring the integrity of the data gathered.

Observers who supported this research were given an invitation to a webinar (online web seminar) on the research if they were interested to know more about the research. Anyone wishing to discuss the process or their experience on a one to

one basis were offered the opportunity to do so. Forty people assessed the TDA, twenty-eight the IPIP-NEO and twenty-six the BF57. No demographic data was gathered in this research.

9.2.3 Analysis - Empirical Definition of Adaptive and Maladaptive

The fifty-seven items in the BF57 had their average score across the twenty-six participants computed. In order to make valid comparisons between adaptive and maladaptive items across the three instruments on an empirical basis a cut off score needed to be defined such that above this point all the items would be deemed to empirically have been judged “adaptive” in the eyes of the twenty-six participants, and below which the items would be deemed “maladaptive”. An inspection of the fifty-seven items in the BF57 found the most socially desirable item was “They believe in themselves and what they can do” from the N– Adaptive scale, which scored 4.5 out of 5.0. The least desirable item was “They are prone to mood swings” from the N+ Maladaptive scale which scored 1.7 out of 5.0.

The adaptive items were all in the top half of the ranked data, and the maladaptive in the bottom half with four exceptions. This was in line with expectations, as the adaptive items were created originally to be either neutral or slightly positive. The cut-off point was set at 2.8 out of 5.0 to minimise the number of items that would be classified differently from the original item pool assessment. This resulted in three items classified as “Adaptive” in the original item pool being deemed “Maladaptive” for this study. These were the Introverted item “Others may view me as reserved” (average score 2.7), the low Openness item “They stick to proven evidence and rarely think outside the box” (average score 2.6) and the low Agreeableness item “They believe arguing their case is more important than worrying about people's feelings” (average score 2.5). Once the cut off was set at 2.8 it was used to consistently break down the Big Five dimensions and undertake an item count for Plus Adaptive, Plus Maladaptive, Minus Adaptive and Minus Maladaptive as shown in Table 9-1, Table 9-3 and Table 9-5. In order to do this, items were assigned to the plus or minus polarity based on whether they were reverse coded or not as assigned by the instrument’s author. This also enabled the calculation of average social desirability scores across the same four categories for each of the Big Five dimensions as shown in Table 9-2, Table 9-4 and Table 9-6. The moderate sample

size (N = 40 for TDA, N = 28 for IPIP-NEO, N = 26 for BF57) made it inappropriate to undertake more sophisticated statistical analysis.

9.3 Results

Table 9-1, Table 9-3 and Table 9-5 present a count of the number of items in each category.

Table 9-2, Table 9-4 and Table 9-6 show the average social desirability scores for each of the categories.

The BF57 has set out to measure adaptive and maladaptive scales at both ends of four of the Big Five dimensions. It has done so for O, C, E and A. Comparing the difference between the average score of each polarity we find the BF57 has less evaluative bias than the IPIP-NEO, which in turn has less evaluative bias than the TDA. Subtracting the "plus polarity" social desirability score from the "minus polarity" social desirability score shows the following differentials:

i. O+ minus O- is 1.8 for the TDA, 0.7 for the IPIP-NEO and 0.6 for the BF57
ii. C+ minus C- is 2.2 for the TDA, 2.2 for the IPIP-NEO and 0.7 for the BF57
iii. E+ minus E- is 1.3 for the TDA, 1.2 for the IPIP-NEO and 0.4 for the BF57
iv. A+ minus A- is 2.6 for the TDA, 1.8 for the IPIP-NEO and 0.2 for the BF57

In addition, the TDA has 39 items measuring O+, C+, E+ and A+ adaptively and 1 item measuring them maladaptively. The TDA also has zero items measuring O-, C-, E- and A- adaptively and 40 items measuring these dimensions maladaptively.

By way of contrast, the BF57 has 12 items measuring O+, C+, E+ and A+ adaptively and 12 items measuring them maladaptively. The BF57 also has 10 items measuring O-, C-, E- and A- adaptively and 15 items measuring these dimensions maladaptively.

Table 9-1: TDA - Item count

Item Categories	TDA Number of items in each cell					
	O	C	E	A	N	Total OCEAN
Plus Adaptive	10	10	9	10	0	39
Plus Maladaptive	0	0	1	0	14	15
Minus Adaptive	0	0	0	0	4	4
Minus Maladaptive	10	10	10	10	2	42
Total	20	20	20	20	20	100

Item Categories	O	C	E	A	N
Plus Adaptive & Maladaptive	10	10	10	10	14
Minus Adaptive & Maladaptive	10	10	10	10	6
Total	20	20	20	20	20

Item Categories	O	C	E	A	N
Measure of Evaluative Bias in item count between Plus and Minus Polarity	0	0	0	0	8

Table 9-2: TDA - Average Social Desirability score

Item Categories	TDA Average Social Desirability Score					
	O	C	E	A	N	Total OCEAN
Plus Adaptive	3.8	4.0	3.8	4.3	-	4.0
Plus Maladaptive	-	-	2.8	-	1.9	2.0
Minus Adaptive	-	-	-	-	3.6	3.6
Minus Maladaptive	2.1	1.8	2.4	1.8	2.6	2.0
Total	2.9	2.9	3.1	3.0	2.3	2.9

Item Categories	O	C	E	A	N
Plus Adaptive & Maladaptive	3.8	4.0	3.7	4.3	1.9
Minus Adaptive & Maladaptive	2.1	1.8	2.4	1.8	3.2
Total	2.9	2.9	3.1	3.0	2.3

Item Categories	O	C	E	A	N
Measure of Evaluative Bias between Plus and Minus Polarity	1.8	2.2	1.3	2.6	-1.3

Table 9-3: IPIP NEO - Item count

Number of items in each cell	IPIP-NEO Number of items in each cell					
	O	C	E	A	N	Total OCEAN
Plus Adaptive	11	11	16	7	0	45
Plus Maladaptive	1	0	2	0	17	20
Minus Adaptive	3	0	1	3	7	14
Minus Maladaptive	9	13	5	14	0	41
Total	24	24	24	24	24	120

Number of items in each cell	O	C	E	A	N
Plus Adaptive & Maladaptive	12	11	18	7	17
Minus Adaptive & Maladaptive	12	13	6	17	7
Total	24	24	24	24	24

Item Categories	O	C	E	A	N
Measure of Evaluative Bias in item count between Plus and Minus Polarity	0	-2	12	-10	10

Table 9-4: IPIP NEO - Average Social Desirability score

Average Score in each cell	IPIP-NEO Average Social Desirability Score					
	O	C	E	A	N	Total OCEAN
Plus Adaptive	3.4	4.3	3.9	3.9	-	3.9
Plus Maladaptive	2.7	-	2.5	-	2.0	2.1
Minus Adaptive	3.1	-	3.4	3.0	3.8	3.4
Minus Maladaptive	2.5	2.1	2.3	1.8	-	2.1
Total	3.0	3.1	3.4	2.6	2.5	2.9

Average Score in each cell	O	C	E	A	N
Plus Adaptive & Maladaptive	3.4	4.3	3.7	3.9	2.0
Minus Adaptive & Maladaptive	2.6	2.1	2.5	2.0	3.8
Total	3.0	3.1	3.4	2.6	2.5

Item Categories	O	C	E	A	N
Measure of Evaluative Bias between Plus and Minus Polarity	0.7	2.2	1.2	1.8	-1.8

Table 9-5: BF57 - Item count

Item Categories	BF57 Number of items in each cell					
	O	C	E	A	N	Total OCEAN
Plus Adaptive	3	3	3	3	0	12
Plus Maladaptive	3	3	3	3	4	16
Minus Adaptive	2	3	2	3	4	14
Minus Maladaptive	4	3	4	4	0	15
Total	12	12	12	13	8	57

Item Categories	O	C	E	A	N
Plus Adaptive & Maladaptive	6	6	6	6	4
Minus Adaptive & Maladaptive	6	6	6	7	4
Total	12	12	12	13	8

Item Categories	O	C	E	A	N
Measure of Evaluative Bias in item count between Plus and Minus Polarity	0	0	0	-1	0

Table 9-6: BF57 - Average Social Desirability score

Item Categories	BF57 Average Social Desirability Score					
	O	C	E	A	N	Total OCEAN
Plus Adaptive	3.8	4.0	3.7	3.7	-	3.8
Plus Maladaptive	2.6	2.5	2.4	2.5	1.9	2.3
Minus Adaptive	3.0	3.1	2.8	3.5	4.3	3.5
Minus Maladaptive	2.4	2.1	2.5	2.3	-	2.3
Total	2.9	2.9	2.8	2.9	3.1	2.9

Item Categories	O	C	E	A	N
Plus Adaptive & Maladaptive	3.2	3.3	3.0	3.1	1.9
Minus Adaptive & Maladaptive	2.6	2.6	2.6	2.8	4.3
Total	2.9	2.9	2.8	2.9	3.1

Item Categories	O	C	E	A	N
Measure of Evaluative Bias between Plus and Minus Polarity	0.6	0.7	0.4	0.2	-2.4

9.4 Study Six Discussion

Table 9-7 Summary of Study Six Hypotheses

Hypothesis	Outcome
H39: The TDA and IPIP-NEO measures of Openness will possess more evaluative bias than the BF57 measure of Openness	Supported
H40: The TDA and IPIP-NEO measures of Conscientiousness will possess more evaluative bias than the BF57 measure of Conscientiousness	Supported
H41: The TDA and IPIP-NEO measures of Extraversion will possess more evaluative bias than the BF57 measure of Extraversion	Supported
H42: The TDA and IPIP-NEO measures of Agreeableness will possess more evaluative bias than the BF57 measure of Agreeableness	Supported

One of the research questions posed in this thesis was “Can the BF57 reduce the impact of evaluative bias in the Big Five?”. Based on the above evidence, it is clear the BF57 has less evaluative bias than both the TDA and IPIP-NEO.

It is worth noting that the sample sizes of (N = 40 for TDA, N = 28 for IPIP-NEO, N = 26 for BF57) are limiting factors in this study. Further research to achieve a sample size of over 100 for each instrument would be ideal. Furthermore, a similar study for the HDS could help ascertain how transparently “dark side” the items are. This may help shed light on some of the puzzling results in study two, where the HDS was correlating positively with many “bright side” traits.

Study six has focused on quantifying how socially desirable items are across the TDA, IPIP-NEO and BF57 instruments. A future research study could achieve a greater sample size and test the statistical significance of the differences in the social desirability scores. Finally, as no demographics were collected, a future study with a larger sample size could look for gender and age differences in social desirability perceptions.

10 GENERAL DISCUSSION

10.1 Research Aims and Research Questions

The first aim of this research was to measure both polarities of the Big Five dimensions as scalar opposites and independent constructs, in order to explore the known issue of differing degrees of social desirability present in Big Five models causing an evaluative bias (Bäckström et al., 2014) and impacting user validity.

The second aim was to measure the polarities of the Openness, Conscientiousness, Extraversion and Agreeableness dimensions in both adaptive and maladaptive forms and then to explore their relationship with highly dysfunctional constructs (Judge, Piccolo & Kosalka, 2009) such as the "dark side" traits measured in the HDS (Hogan & Hogan, 1997; Hogan, Hogan & Kaiser, 2010).

The third aim was to establish if the new model (termed the BF57) could be useful to researchers through understanding the convergent and divergent validity of the scales, including locating them in the periodic table of personality traits (Woods & Anderson, 2016).

The fourth aim was to explore the positive and negative correlations between workplace performance and adaptive / maladaptive traits at both poles of each Big Five construct and in so doing, to establish the criterion validity of the model.

Finally, the fifth aim was to shed light on the bandwidth / fidelity debate through empirically testing higher and lower level models on the data gathered.

The above aims were addressed through a novel application of Peabody's (1967) method for reducing evaluative bias. For each of the Openness, Conscientiousness, Extraversion and Agreeableness dimensions, the approach involved taking what would normally be one evaluatively unbalanced dimension and dividing it into four collectively balanced scales. Items were created to measure the low end of each scale, both adaptively and maladaptively. Items were also created to measure the high end of each scale, again adaptively and maladaptively.

This technique was combined with Burisch's (1986) recommended inductive, deductive and criterion-centric approach in order to develop an integrated Big Five model of personality. In so doing, the BF57 personality predictor model created successfully integrated the Big Five with ideas from both Jungian psychology and knowledge from other researchers on personality correlations with the Great Eight (Bartram, 2005) competency model. This was done in part through the quantification of performance at work through utilising a series of Great Eight (Bartram, 2005) based behavioural competencies assessed using 360-degree feedback. The BF57 was then used to explore key research questions and test a number of hypotheses in this thesis. The nine key research questions fully explored in this thesis are as follows:

RQ1: Is the proposed BF57 model of personality compatible with the Big Five factor structure?

RQ2: Where do the BF57 scales sit in the personality periodic table (Woods & Anderson, 2016) of blended Big Five factors?

RQ3: Do the BF57 adaptive scales correlate more highly than the BF57 maladaptive scales, with other "bright side" Big Five traits?

RQ4: Do the BF57's maladaptive scales correlate more highly than the BF57 adaptive scales, with the HDS "dark side" traits?

RQ5: What evidence is there to support the conceptualisation of BF57 maladaptive scales as overplayed / overextended / extreme ends of the "bright side" Big Five traits?

RQ6: How well does the BF57 comply with *a priori* hypothesized criterion validity relationships with the Great Eight competency model?

RQ7: Is there a differential pattern of criterion validities between the BF57 adaptive and maladaptive scales and if so, what can be learnt from this?

RQ8: Compared to the BF57 five-dimensional bandwidth approach, can the higher fidelity BF57 eighteen scales explain more of the variance in the personality criterion relationship?

RQ9: Can the BF57 reduce the impact of evaluative bias in the Big Five?

In answering these questions, the current set of studies has produced a series of findings of considerable importance when viewed in relation to existing literature around the Big Five. These can be summarised via answering the key research questions posed in turn.

Research Question One: *Is the proposed BF57 model of personality compatible with the Big Five factor structure?*

Research question one was addressed through studies one and two. Hypotheses numbers **H1**, **H2**, **H3**, **H4**, **H5** and **H6** were used to address this research question and evidence was found to support all six hypotheses. The first study created the BF57 questionnaire. A 410-strong item pool designed to measure the eighteen BF57 scales was created and after 2,506 people completed it, EFA and CFA were used to explore the underlying structure of the Big Five and create the fifty-seven item instrument. The fifty-seven items were chosen on the basis of having the best statistical properties out of the 410 and were selected to ensure a broad as well as reliable set of measures of the eighteen variables.

The second study assessed the convergent and divergent validity of the BF57. It identified and tested hypotheses concerning how the BF57 correlates with other instruments, including the IPIP-NEO, the HPI, the HDS and the TDA. A Multitrait-Multimethod analysis also supported the convergent and divergent validity analysis. This study went on to apply the periodic table methodology advocated by Woods and Anderson (2016) which enabled the BF57 scales to be located within the 45 blended factors of the periodic table.

The results from these studies have provided substantial support for the assertion that the BF57 is a five-factor model with an internally valid construct. At the level of the five dimensions measured by the IPIP-NEO, all five correlate at least 0.59

(corrected) with the BF57. BF57 and the four HPI equivalent dimensions of Conscientiousness, Extraversion, Agreeableness and Neuroticism also exceed the 0.45 convergent validity standard, with Openness just dipping below at 0.44 (corrected). Similarly, when the Trait Descriptive Adjectives had five Big Five dimensions created from the adjectives, all five correlated above the required standard with the BF57 (the lowest of the five is Agreeableness with a corrected correlation of 0.50).

A Multitrait-Multimethod analysis with the same three instruments produced a similarly encouraging picture for the IPIP-NEO and TDA correlations with the BF57. However, in the Multitrait-Multimethod analysis the BF57 correlations with the HPI dipped to 0.38 (uncorrected) for Openness and 0.28 (uncorrected) for Agreeableness. An inspection of the HPI correlations with the IPIP-NEO based on the same sample (N = 105) revealed the Agreeableness correlation is a relatively low 0.45 here too, and similarly for the TDA it is a relatively low 0.46. Consequently, it is likely the lower correlations between the BF57 and HPI Openness and Agreeableness scales may be in part a feature of a relatively low sample size, with N = 105.

The TDA data was also used to locate the eighteen scales in the BF57 in the personality periodic table (Woods & Anderson, 2016). All eighteen scales were located in the periodic table within the intended area of Big Five elements and this provides further strong evidence the BF57 is indeed measuring the Big Five.

Taken together, the above correlations between the BF57 and the IPIP-NEO, TDA and HPI do support the argument that the BF57 is a model of the Big Five. However, it is clear from the results of the confirmatory factor analysis that these factors cannot be considered as completely independent of one another, as the scales within any given factor may also be related to other scales and factors. Evidence of the complexity of the true Big Five structure was also found in the fourth study that re-validated the BF57 through gathering and analysing a second sample. This study re-validated the Big Five dimensions and the eighteen scales, and although simple structure was not achieved, some of the in-depth correlations found in the previous confirmatory factor analysis could be seen in this second sample. The fourth study

also undertook a test-retest analysis and found good evidence of the reliability of the BF57 at the Big Five level and the eighteen-scale level.

The fifth study assessed the consensual validity of the BF57 by gathering BF57 based 360-feedback and correlating the self-perception of the participants' five dimensions and eighteen scales with 360 observer feedbacks on the same scales. This rater feedback provided evidence the BF57 does indeed possess a Big Five structure and further supported the instruments claim to be reliable.

Summarising the situation regarding this first research question, one of the major findings of this research is that, for the first time, not only is it possible to measure the Big Five factors at both ends of the polarities but that the Openness, Conscientiousness, Extraversion and Agreeableness factors may also be assessed adaptively and maladaptively at both ends, while still retaining the integrity of the Big Five structure.

Research Question Two: *Where do the BF57 scales sit in the periodic table of blended Big Five factors, as advocated by Woods and Anderson (2016)?*

The following hypotheses were supported by the evidence gathered in study two. This evidence contributed to answering the research question through confirming the alignment of the BF57 with the TDA's Big Five structure:

H3: BF57 Big Five dimensions converge with TDA Big Five **(Supported)**

H4: BF57 Big Five dimensions converge with IPIP-NEO Big Five **(Supported)**

H5: BF57 Big Five dimensions converge with HPI Big Five **(Supported)**

H6: Multitrait-Multimethod convergent and divergent validity with BF57, TDA, IPIP-NEO and HPI **(Supported)**

This second research question was addressed in study two. All eighteen scales in the BF57 have been successfully located in the periodic table after applying the methodology advocated by Woods and Anderson (2016). As mentioned previously, all eighteen scales had a primary loading on the intended Big Five factor.

Importantly, within each primary factor the periodic table approach enabled the BF57 scales to be located according to both their primary and secondary loadings.

The periodic table approach to personality has shown that some combinations of factors have been more heavily researched than others. For example, a blend of Extraversion and Openness is almost twenty-four times more likely to be measured by popular psychometric instruments than a blend of Agreeableness and Openness (Woods & Anderson, 2016). Interestingly, some blends of factors have not historically been measured at all in the periodic table – which may imply that people who manifest these characteristics are of less interest and perceived worth in the workplace. One of the consequent outcomes and values of the BF57 is that it measures blends of factors less common in other instruments. In fact, it measures one combination (Conscientiousness and reversed Emotionally Stability) which Woods and Anderson (2016) indicates is not measured by any of the top ten instruments. Therefore, it can be argued the BF57 is in fact correcting for forms of bias it was not originally intended to address.

An inspection of the three items that measure the BF57 scale "C+ Maladaptive" indicates they do have good face validity for measuring the blended factors of Conscientiousness and reversed Emotionally Stability. The items are "My focus on my commitments can make it difficult for me to make spontaneous decisions", "I can stick too rigidly to a plan" and "I find it difficult to work with those who like to work last-minute". It would appear the Conscientiousness based desire for order is blended in all three of these items with an anxiety that could be linked to Neuroticism.

Research Question Three: *Do the BF57 adaptive scales correlate more highly than the BF57 maladaptive scales, with other "bright side" Big Five traits?*

This third research question was addressed in study two. There is good evidence to suggest the positive poles of the "bright side" Big Five measures of personality in the IPIP-NEO, TDA and HPI instruments do correlate more highly with adaptive rather than maladaptive scales in the BF57.

Firstly, hypotheses were tested for the four dimensions of the Big Five for which versions of both adaptive and maladaptive items exist at both polarities (Agreeableness, Conscientiousness, Extraversion and Openness). Steiger Z-transformations for dependent samples were undertaken to test for significant differences between the magnitude of the observed correlations between BF57 adaptive and maladaptive scales and the positive pole in the other instruments. For the IPIP-NEO all four hypotheses were supported, as they were for the TDA. The picture for the HPI was less conclusive with only the Agreeableness hypothesis being supported and the Extraversion hypothesis being partially supported. The hypotheses for Openness and Conscientiousness were not supported. However, a further broader hypothesis that examined the 56 possible point to point *a priori* BF57 scale to HPI trait correlations found the adaptive BF57 scales correlated more highly with the HPI traits than the maladaptive scales on 42 occasions, which is very unlikely to happen by chance ($p = 0.00011722$). This offers some evidence to suggest the BF57 adaptive scales do correlate more highly with the HPI traits than the BF57 maladaptive measures.

We can conclude, as hypothesised, the BF57 adaptive scales are predominantly Big Five measures of “bright side” adaptive traits.

Research Question Four: *Do the BF57’s maladaptive scales correlate more highly than the BF57 adaptive scales, with the HDS “dark side” traits?*

H11: HDS Moving Against correlation greater with BF57 E+ Mal than E+ Ada **(Not Supported)**

H12: HDS Moving Against correlation greater with BF57 O+ Mal than O+ Ada **(Not Supported)**

H13: HDS Moving Away correlation greater with BF57 E- Mal than E- Mal **(Supported)**

H14: HDS Moving Away correlation greater with BF57 A+ Mal than A+ Ada **(Supported)**

H15: HDS Moving Toward correlation greater with BF57 C+ Mal than C+ Ada **(Not Supported)**

H16: Of the 45 pairs of "moving away" correlations, more have higher correlation with maladaptive BF57 than adaptive BF57
(Supported)

H17: Of the 36 pairs of "moving against" correlations more have higher correlation with maladaptive BF57 than the adaptive BF57
(Not Supported)

H18: Of the 18 pairs of "moving toward" correlations more higher correlation with maladaptive BF57 than adaptive BF57
(Not Supported)

This fourth research question was also addressed in study two. The evidence suggests that the BF57 maladaptive scales correlate more highly with the HDS "Moving Away" dark side traits, than the BF57 adaptive scales. This is in line with expectations and as hypothesised. However, this picture is inconclusive for the HDS "Moving Toward" dark side traits. That is, there seems to be no statistically significant difference between BF57 adaptive and maladaptive scale correlations with HDS "Moving Toward" traits. The picture for the HDS "Moving Against" dark side traits is puzzling as there is evidence that shows the adaptive BF57 scales correlate more with the HDS "Moving Against" dark side traits than the BF57 maladaptive traits do. Possible reasons for this could include that the maladaptive items in the BF57 possess face validity, but lack criterion validity with true dark side behaviours. This seems unlikely given that later in study three, BF57 maladaptive traits were found to negatively impact performance at work, compared to adaptive traits. It could also be the case that the HDS "Moving Against" scales are not as maladaptive as previously supposed and contain a substantial adaptive component. That is to say, the HDS "Moving Against" traits may genuinely support positive performance at work in many contexts. This would be consistent with the findings of Kurz, Saville and MacIver (2010) and Hogan and Hogan (1997, p. 37) who themselves report many HDS traits correlating positively with bright side traits. For example, the HDS trait "Mischievous" correlates 0.35 with HPI Inquisitive (which

corresponds to Big Five Openness) and 0.47 with HPI Sociable (which corresponds to Big Five Extraversion). Furthermore, Hogan and Hogan (1997, p. 63) also report 360 observer feedback showing HDS traits can be both adaptive and maladaptive in the eyes of work colleagues. For example, the HDS scale “Mischievous” correlates 0.17 with both maladaptive behaviours “Is arrogant” and “Is deceitful”. However, it also correlates 0.16 with the adaptive behaviour “Acts in a socially appropriate manner”.

This suggests the BF57 casts important light on the meaning of the HDS and, in fact, there exists a two-way street in interpretation between the two instruments. For example, correlations between the four different scales of the BF57 measures of Openness (which range from +0.66 to -0.59) with the HDS “Imaginative” scale imply both adaptive and maladaptive aspects are present in this HDS measure. There are similar BF57 to HDS correlational patterns across many of the scales / traits. This poses challenges to the claim that the HDS instrument predominantly measures maladaptive or dark side traits that are fundamentally “dysfunctional personality syndromes” (Hogan & Hogan, 1997, p. 1). Whilst Hogan and Hogan (1997) do acknowledge the dark side may contain some positive aspects, the evidence suggests that there may be more ‘light’ in the dark side than previously supposed. This would accord with Kurz, Saville and MacIver’s (2010) contention that the HDS instrument is not measuring dysfunctional personality syndromes that negatively impact work performance as much as many practitioners think and is likely to be capturing much of the broader variance in the Big Five.

Research Question Five: *What evidence is there to support the conceptualisation of BF57 maladaptive scales as overplayed / overextended / extreme ends of the "bright side" Big Five traits?*

This fifth research question was addressed in studies two and three. BF57 maladaptive scales either negatively correlate with performance (i.e. are performance blockers), or where a BF57 adaptive scale correlates positively with performance, the maladaptive form of it typically correlates less with performance (i.e. are performance degraders) or not at all. This supports the notion that maladaptive BF57 scales really do, on the whole, negatively impact performance at work, compared to their adaptive form.

This, combined with the finding that there are generally high correlations between the adaptive BF57 scales and the equivalent maladaptive BF57 scales within each Big Five polarity, does suggest the maladaptive forms can be conceptualised as “too much of a good thing”.

Research Question Six: *How well does the BF57 comply with a priori hypothesized criterion validity relationships with the Great Eight competency model?*

H19: “Analysing Situations” will correlate positively with at least one of the positive Openness scales, or negatively with at least one of the negative Openness scales **(Not supported)**

H20: “Creating Concepts” will correlate positively with at least one of the positive Openness scales, or negatively with at least one of the negative Openness scales **(Supported)**

H21: “Relating to People” will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales **(Supported)**

H22: “Controlling Resources” will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales **(Not Supported)**

H23: “Respecting People” will correlate positively with at least one of the positive Agreeableness scales, or negatively with at least one of the negative Agreeableness scales **(Supported)**

H24: “Adapting to Demands” will correlate negatively with the positive Neuroticism scale, or negatively with the positive Neuroticism scale **(Supported)**

H25: “Delivering Results” will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales **(Supported)**

H26: “Driving Performance” will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales **(Supported)**

H27: “Sum of All Eight” will correlate positively with at least one of the positive Conscientious scales, or negatively with at least one of the negative Conscientious scales **(Supported)**

H28: “Sum of All Eight” will correlate positively with at least one of the positive Extraversion scales, or negatively with at least one of the negative Extraversion scales **(Supported)**

H29: “Sum of All Eight” will correlate positively with the negative Neuroticism scale, or negatively with the positive Neuroticism scale **(Supported)**

H30: Adaptive scales consistently correlate more highly with the Great Eight competency criterion than the maladaptive scales. **(Supported)**

H31: It was hypothesized across the 64 possibilities, a statistically greater than chance number would show a statistically significant difference in the correlation coefficients between the adaptive and maladaptive scales **(Supported)**

The third study assessed the criterion validity of the BF57. In this study, criterion validity hypotheses were tested using 360-degree feedback based on assessing performance at work. The Great Eight competency model and two other competency models were used for this purpose. *A priori* hypotheses explored the relationship between the BF57 scales and the “Great Eight” competencies. Correlational and regression analysis were used to identify which scales accounted for more of the variance.

Overall varying levels of support were found for 9 of the 11 *a priori* hypotheses made concerning the correlation between the BF57 and performance at work as measured by the Great Eight competencies. Researchers wishing to explore how individual’s Big Five dimensions and scales may impact their Great Eight performance both positively and negatively, within one simple relatively short instrument, may wish to consider using the BF57.

Research Question Seven: *Is there a differential pattern of criterion validities between the BF57 adaptive and maladaptive scales and if so, what can be learnt from this?*

This seventh research question was addressed in study three. A considerable body of evidence has been adduced in favour of the criterion validity of the BF57 structure, with performance enablers and performance blockers identified. A strong evidence base has been gathered that demonstrates that maladaptive aspects of personality can impact performance at work in a deleterious manner. This is borne out by the data captured, with many maladaptive traits having a statistically negative correlation with multiple behavioural competencies. However, the situation is complex, and some maladaptive scales still have a statistically significant positive correlation with some behavioural competencies. Furthermore, none of the maladaptive traits are statistically significantly detrimental to performance across all eight of the Great Eight competencies.

Another example of the interesting differential relationship between BF57 adaptive and maladaptive scales and performance is found in the “Positive Conscientiousness Adaptive” (C+ Ada) BF57 scale, which covers being reliable, planning ahead etc. This BF57 scale correlates positively with the “Delivering Results” competency with r = 0.28 (uncorrected). However, the maladaptive form of the same BF57 scale (C+ Mal) has no statistically significant impact (positive or negative) on “Delivering Results”. That is, in this case, having “too much a good thing” has no positive or negative impact on performance.

An example of a differential relationship where the maladaptive has more impact can be found in the relationship between Introversion and the competency “Respecting People”. “Positive Introversion Adaptive” (E- Ada) covers listening before speaking, being quiet etc. No evidence was found that this BF57 scale had a statistically significant correlation with “Respecting People”. However, E- Mal correlates with r = -0.14 (uncorrected) with “Respecting People”. This means that Introversion is not detrimental to “Respecting People” unless it becomes maladaptive.

Researchers such as Grant (2013) have advocated looking for curvilinear relationships between personality traits and performance. For example, Grant (2013) found Extraverted sales people achieved more sales as they became more extraverted up to a certain point, but then too much Extraversion started to block performance. Such phenomenon can now be explored with the BF57 to establish if it is maladaptive Extraversion that causes the performance issue and to find out if adaptive Extraversion by itself does not have a curvilinear relationship with performance. Equally, the impact of maladaptive Introversion on sales performance can be explored with more fidelity.

Weighing all this up, a detailed examination of all the correlates of maladaptive scales and their occasional relationship to positive work performance is one reason for exercising caution in matters of interpretation. That said, overall and as expected, compared to adaptive traits, maladaptive traits tend to have lower correlations with positive performance at work and higher ones with negative aspects of work performance. This knowledge enables a deeper and more detailed exploration of those aspects of an individual's personality, which may possibly affect their work. If a short report on such an exploration was to be provided to a test taker, it must be stressed that it would not be intended to be used in a deterministic fashion, as to do so would be to fall prey to the confounding error of ecological fallacy.

Research Question Eight: *Compared to the BF57 five-dimensional bandwidth approach, can the higher fidelity BF57 eighteen scales explain more of the variance in the personality criterion relationship?*

The following hypothesis was tested and supported:

> **H32:** Within each Big Five dimension a regression of the 4 scales for O, C, E and A, and of the 2 scales for N, will produce a stronger relationship (as measured by the multiple correlation coefficient) than for the same items in the BF57 used to create 1 measure of O, C, E, A and N. It is hypothesized that this will be the case for the eight competencies in the Great Eight model. **(Supported)**

This eighth research question was addressed in study three. This study showed that all eight of the Great Eight competencies have more of their variance explained by a greater fidelity approach. This was evidenced by comparing the multiple correlation coefficients between a Big Five dimension and performance and contrasting it with the equivalent multiple correlation coefficients based on a regression on the underlying scales within the same Big Five dimension. The probability of this result occurring by chance was 1 in 2^8, which is equal to 0.00391. It is clear evidence has been found to support the fidelity side of the bandwidth/fidelity debate.

Reflecting on this more generally and moving up to an even higher bandwidth level, some evidence was found consistent with Digman's (1997) formulation suggesting two higher order factors do exist. For example, in the confirmatory factor analysis, Openness and Extraversion were found to load onto the same factor (see Table 4-8). Further work could be undertaken with the current data set to test for both of Digman's proposed higher order factors, as well as the "Big One" identified by Musek (2007) and to see how they may correlate with performance at work.

However, in terms of understanding performance at work, the evidence here suggests a more fruitful approach will result from examining more lower level facets underneath the Big Five - as many studies have shown that these have a greater predictive capacity when compared to moving up to higher level combinations of factors or even to just one factor. In other words, drilling down into the Big Five facets seems more promising than summing up, at least in terms of criterion validity as measured in the workplace. In the BF57 in particular, as the more detailed lower level facets are uniquely profiled and balanced, this better enables diversity to be valued. This occurs as people with many different ways of being will find their personality nuances have been constructively assessed and the contribution of it to aspects of their performance highlighted, which can be experienced as validating. This also helps reduce the impact of unwanted measurement values and biases as identified by Kelly (1955). Measurement as Kelly (1955) argued, embodies particular values.

Research Question Nine: *Can the BF57 reduce the impact of evaluative bias in the Big Five?*

The following four hypotheses were all tested and supported:

H39: The TDA and IPIP-NEO measure of Openness will possess more evaluative bias than the BF57 measure of Openness **(Supported)**

H40: The TDA and IPIP-NEO measure of Conscientiousness will possess more evaluative bias than the BF57 measure of Conscientiousness **(Supported)**

H41: The TDA and IPIP-NEO measure of Extraversion will possess more evaluative bias than the BF57 measure of Extraversion **(Supported)**

H42: The TDA and IPIP-NEO measure of Agreeableness will possess more evaluative bias than the BF57 measure of Agreeableness **(Supported)**

The sixth study sought to measure the evaluative bias in the TDA, IPIP-NEO and BF57. The social desirability of all the items in all three instruments was measured and the aggregated social desirability scores for the Big Five dimensions were compared across the instruments.

After applying Peabody's (1967) methodology to reduce evaluative bias, evidence has been gathered that shows the evaluative bias of the BF57 in measuring the Openness, Conscientiousness, Extraversion and Agreeableness dimensions is substantially less than the evaluative bias in the Trait Descriptive Adjectives (Goldberg, 1992) and the IPIP-NEO (Johnson, 2014). Researchers concerned about evaluative bias in Big Five models may wish to consider using the BF57, as it has significantly reduced evaluative bias in measuring the Big Five.

10.2 The Findings in Context of Others' Research

10.2.1 Peabody's vs Bäckström's Method

At the level of measuring the Big Five, the BF57 has been shown to have less evaluative bias than both the TDA and the IPIP-NEO. The BF57 methodology for reducing bias was adapted from the work of Peabody (1967). This method involves measurement of items with both positive and negative valence, at both poles, and assumes the various biases will equal each other out. However, this method has not totally removed all the evaluative bias between both ends of the polarities in the

BF57. Bäckström et al.*'s* (2104) method of removing bias is different and involves actually changing the items, until all scales have the same mean score centred hopefully around the mid-point of a Likert scale. Provided the items are iteratively "neutralised" over time, this method is likely to be more successful at removing almost all bias.

However, Bäckström et al.*'s* (2104) method does have some costs associated with it. For example, in a developmental setting, Bäckström's method loses the user validity benefit of being able to share with a test taker their scores both adaptively and maladaptively at both ends of the Big Five. Instead of receiving the four scores underpinning a Big Five dimension, as in the BF57, the test taker would receive just one bias free number. A parallel could be drawn, with one measure being akin to working with only one point on a compass and the compass only providing confirmation when the individual is travelling in that one direction. Arguably, in a developmental setting, the extra user validity contained in knowing all four points on the compass through sharing the four scales, under a Big Five dimension, is of more utility than a further, but marginal, reduction in evaluative bias.

In a selection setting, the removal of social desirability is considered important by many (but not all – see Costa and Lord (2004)). In a selection scenario where sometimes the test taker will never see their test results, then the case for Bäckström's method is increased, as social desirability is something many recruitment consultants go to great lengths to minimise. That said, one selection benefit of measuring four scales under a Big Five dimension, is that any candidate in a selection situation who responded in a socially desirable way may have their tactics exposed by the lower scores they will achieve across all the maladaptive scales. This can also be helpful data for the test user.

10.2.2 To Pathologize or Not to Pathologize?

The criterion validity data in this research has been found to support the conceptualisation of maladaptive traits as "too much of a good thing" that may not be helpful in certain workplace contexts. In does seem to be the case that individuals can overplay, or overly rely on, what may seem to be their strengths to the point at which they hinder performance. In this regard, the BF57's research base is quite

different from the research underpinning the HDS (Hogan & Hogan, 1997) and Guenole's (2015) DSM-5 based six "maladaptive" traits questionnaire and the BF57 is not therefore presented as a measure derived from or measuring mental disorder or psychopathology. Consequently, this research argues for avoiding pathologizing in the workplace, and instead redefines maladaptive traits as likely to have a negative impact on performance at work. However, it could be argued, that if the HDS measures dark side traits, and the HDS traits correlate with the BF57 maladaptive traits, then maybe the BF57 is in fact measuring dark side traits and pathologizing after all. The counter argument would be that the HDS is known to correlate positively with other instruments' Big Five scales, which one can argue weakens its claim to be strongly measuring such dysfunctional traits. Finally, it is also the case that the HDS and BF57 may correlate positively, whilst still both having valid yet different theoretical bases.

10.2.3 Bias in Personality Models and Competency Models

This thesis has identified bias in how many Big Five models measure the polarities of their scales. However, could it also be that a similar bias has filtered through into competency models that measure performance at work more in terms of the same socially desirable polarities?

One could argue that there is no logical reason why competencies that drive performance at work should be balanced in terms of Big Five polarities. The argument advanced in this thesis, that measuring personality in a balanced way helps value different ways of being does not imply competency models need to be balanced in a similar way. Any competency differences linked to Big Five polarities in a potentially "unbalanced" way could be rationally justified if this enhanced overall performance. This perspective is supported by the work of Bartram (2005) and Hopton (2012) who found combined measures of the Great Eight competencies are good indicators of externally measured performance at work, such as an individual's overall annual performance rating or the degree to which sales targets are achieved. However, a case can be made that the literature on the Great Eight (Bartram, 2005) does indicate it was consciously developed based on a desire to maximise criterion validity and so designed elements of positive Openness, positive Conscientiousness, positive Extraversion, positive Agreeableness and negative

Neuroticism into the eight competencies. Another similar example would be the Saville Wave personality model that was designed simultaneously with a competency model in order to maximise criterion validity (Saville et al., 2009). Further research could explore if a competency model developed with no reference to personality, and no desire to maximise criterion validity with a personality model, would produce a different, and in Big Five polarity terms, maybe less biased model of performance. This would require considering what a culture may consider to be desirable competencies at work and quantify how this may impact overall performance. This is a complex task as Grant et al. (2011) found employees often hold implicit beliefs on leadership based on the charismatic and extraverted role models they have grown up with in their culture, which can create a "halo effect" when they need to provide 360 feedback on leaders. This implies that we cannot rely on 360 observer feedback as a bias free measure of performance. Further research is required in this fascinating area.

10.3 Psychometric and Organisational Relevance of the Findings

10.3.1 The Risk of Stereotyping

The non-independence of the Big Five factors has large implications for how psychologists, psychometricians and coaches help individuals interpret their psychometric reports. The risk of inadvertently leaving an individual with an oversimplified and stereotyped perspective should not be underestimated. Problems can arise if individuals are left viewing their personality through the lens of the Big Five as a static high-level model made up of five independent factors and start to see themselves in these overly simplistic terms. The actual feedback given should not be assumed to be identical to the message received. This is well understood from studies of the doctor/patient communication (Tollow & Ogden, 2017) where the transmitted information with regards to diagnosis, prognosis and nature of treatment is not always congruent with the patient's understanding. Therefore, in the current context of performance at work, considerable care is required to assist individuals' understanding of their psychometric profile and the implications this may have for them, both with respect to their work performance and their life outside of work.

If an individual does inadvertently leave with a stereotyped perspective, the further risk is that they will extend this restricted outlook of themselves onto how they view others and their relationships with them and onto how they view the wider world. This is something that can have unanticipated consequences across multiple contexts. These consequences could include forming ungrounded and/or unhelpful beliefs regarding the behaviours needed to be successful at work ("you need to be extraverted to do well in this organisation"). Moreover, such beliefs may encourage implicit gender bias that contributes to the glass ceiling some women experience at work ("showing empathy is a sign of weakness, you need to be competitive to be successful here"). Broader consequences could include the fuelling of unconscious biases, or developing new biases in relation to colleagues and other workers, something which itself may be the beginning of an unpredictable chain of influences.

A further risk with a static high-level Big Five model is that it may encourage people to consider their personality as fixed and unchanging. The scales in the BF57 inherently encourage a participant to consider the possibility that they can manifest aspects of who they are at both ends of a Big Five polarity in different contexts and that they may do so in a manner which is either helpful or unhelpful. Hence the BF57 embodies a dynamical view of personality that accords with Trait Activation Theory (Tett & Burnett, 2003). This is helpful, arguably even necessary, given the shifting work environment within which many employees find themselves. In turn, organisations themselves are faced with a continuous challenge to adapt to changing circumstances, a challenge which must necessarily impact on the workforce. These are fluid aspects of contemporary life which Bauman (2013) refers to as liquid modernity, and call for a similarly fluid and dynamic work-performance and personality model.

10.3.2 The Dynamical Nature of Personality and Work

Research from thirty years ago led some to conclude that Conscientiousness was the "g" factor (Jensen, 1998; Kurz, 2000) of personality and could be used as a generalisable trait on which to base the majority of employment selection decisions. It could be argued that this "one size fits all" approach is based on a non-dynamic view of personality, which raises a wider societal concern that this approach writes off as unsuitable for employment a significant percentage of society (Bartram, Baron

& Kurz, 2003). By way of contrast, the BF57 adopts a more nuanced and more humanistic approach. An implication of the multifaceted way in which the BF57 assesses personality and the relationship of its measures to performance at work, is that attempts to measure personality must be responsive to the dynamical nature of people and organisations. The BF57 argues for a humanistic approach to the application of psychometrics, whereas some would typically characterise psychometrics as reductionist. The current approach as such calls for a dialogue between the person completing the questionnaire and their coach / psychologist / assessor and a change in the language used to depict such encounters. If this approach were to be more widely adopted, it may make personality assessment a tool more likely to be embraced by a greater number of counsellors and psychotherapists. In sum, it could be a catalyst for dialogue and development rather than a means for reducing somebody to a number or an acronym.

10.4 Acknowledgement of the Studies' Limitations

The key strength of research on the Big Five has been the large number of repeated studies globally measuring the dimensions using self-report as well as 360-degree observer data. This research has provided a growing body of evidence linking personality variables to performance at work. Nevertheless, there are a number of caveats to the current work. As with other Big Five research, this thesis has encountered some methodological challenges. Firstly, much of the data gathered is based on participants in the United Kingdom, as well as the United States and Canada. The term WEIRD has been coined by Henrich, Heine and Lorentzian (2010) to describe studies based on "Western, educated, industrialised, rich, democratic countries" (p. 61). Further studies from around the world are needed to explore how generalizable this thesis' research is to different cultures and education levels. Such work would necessarily involve the problem of translation – both in a narrow linguistic sense and in a wider cultural sense. The problems encountered could be expected to be unique to each setting in which data was to be gathered.

It is also the case that in this research a disproportionate number of the participants were female. The extent to which the measures of personality are consistent across genders and in relation to criterion measures was not investigated here, although this could certainly be investigated in future work. Previous research however does

not suggest marked personality differences between the genders (Weisberg, DeYoung & Hirsh, 2011).

Secondly, self-report personality inventories are considered to be prone to measurement error. The issues include social desirability being present whilst completing a questionnaire, as well as participants having different perceptions of what a question is actually measuring and different interpretations of the measurement scales. To a certain extent these issues are addressed by gathering 360-degree observations, which are known to be less prone to such bias. The use of 360 data in designing models of personality has been strongly advocated by Hogan and Hogan (1995) exactly for this reason. That said, it has to be considered that 360-degree observations may introduce other kinds of biases, such as the personality of the observer, the degree to which the observer knows the person observed (and any associated halo or stereotyping effect), their pre-conceived ideas as to what adaptive and maladaptive behaviours look like and the cultural assumptions about the nature of personality in a leadership or workplace context. All of these limitations, however, are empirical and therefore could be addressed in future research. Such research could in fact only deepen our understanding of the nature of personality and our limitations in assessing it.

All the criterion measures in this thesis are based on 360-degree observations. Further research is needed to replicate criterion validity using entirely different but still relevant criteria such as key performance indicators. For example, for people working in a sales environment, to what extent do sales people meet their sales targets or for people working in a call centre environment, how satisfied are their customers with their interactions? Other possible criteria could include measures of team effectiveness, staff engagement, anti-social behaviour or staff retention. A further question is whether a single measure of overall performance can be derived which could function as a useful overall criterion. Even if new and interesting criterion measures could be found, there is still the question of how, in a given workplace setting, the criterion may impact broader measures such as productivity, return on investment and the social and economic goals of an organisation.

One of the limitations of the current work concerns the degree of precision in some of the criterion measures. For example, the Great Eight competencies were

assessed using single-item measures. The validity of these in comparison to a more comprehensive instrument is unknown. However, the single item measures do possess the advantage of brevity which enable data to be gathered from more people in a shorter period of time. In addition, the Great Eight descriptors were provided by the author of the longer instrument (Kurz, 2003) and so possess intrinsic face validity. Kurz (personal communication) advised that the use of eight Great Eight marker items was highly appropriate in this research setting.

There are also issues of causal inference. While this research and many other researchers have found that personality can predict performance across different competencies, few studies can prove a causal relationship. It is possible that other variables not measured in personality or performance at work questionnaires may be at play. More work of a longitudinal nature is needed in the field of psychology to develop designs that can adjust for such factors.

10.5 Suggestions for Further Research

The extensive validation of the BF57 and the questions which arise from this process suggest a number of promising lines for further research.

First of all, the work opens up the prospect of replicating the confirmatory factor analysis on new samples in different workgroups and in different countries. Such work would fill an important gap in the methodological as well as the personality literature where replication of structural equation models has been problematic (McCrae, Zonderman, Costa, Bond & Paunonen, 1996).

Now that this research has established that both polarities can be measured adaptively and maladaptively in the Big Five, it would be of interest to ascertain the extent to which individuals may be found in different combinations of the polarities. For example, in considering Agreeableness, an individual could score in the mid-range using the IPIP-NEO for example, yet this may hide a propensity to be highly Agreeable in certain contexts, yet highly Direct (and disagreeable) in other contexts. The BF57 is able to discern whether someone is high at both ends, medium at both ends or low at both ends, all of which would produce similar single scores using a more traditional approach such as the IPIP-NEO. Hence research could be

undertaken to discover the differential impact on performance at work of these different profiles. A similar issue arises when considering profiles, which are based on combining adaptive and maladaptive measures. How the possible different combinations could play out in the workplace and whether particular combinations exert particularly strong positive or negative influences is presently largely unknown.

Research is also called for to explore the scenario in which some job roles place extreme demands on an individual. Could it be that certain maladaptive traits detrimental to performance in many roles, could actual be essential to performance in a specific role where the job demands are extreme (e.g. a soldier about to go into combat)? Research is called for to understand the theoretical basis of such a dynamic model and "Trait Activation Theory" (Tett & Burnett, 2003) and Fleeson's (2001) concept of traits being density distributions of states have created much research that would be a starting point for this.

One of the benefits of Woods and Andersons' (2016) periodic table is that the impact of combinations of Big Five factors (Woods and Anderson suggest the existence of 45 different factor combinations) on workplace performance can be quantified. Building on this innovation, an extended periodic table could be created measuring blends of opposite polarities - both adaptively and maladaptively. For example, what is the impact on performance of being both highly extraverted adaptively (e.g. orally persuasive and energetic) and highly introverted adaptively (e.g. measured and listening before speaking)? Could it be this combination may produce effective performance at work?

Similarly, what would be the impact on performance of being low on Extraversion adaptively (e.g. not orally persuasive and low on energy) and high on Introversion maladaptively (e.g. quiet in group meetings and often listening too much without speaking)? Could it be this combination may be toxic for effective performance at work?

Such interesting combinations could well result in new blended factors creating new 'elements' for the periodic table of personality. The criterion validity of these new blended factors can then be explored. A related concept that also merits further research, is finding interesting combinations of Big Five scales that although they

do not constitute a blended factor, may nevertheless combine to form a type, as outlined by Sava and Pope (2011). Research to identify types using cluster analysis within the current data set gathered in study one would a be a fruitful place to start, followed by seeking to quantify the criterion validity of the types.

An interesting idea this thesis raises is the possibility that some individuals may exhibit behaviours that are highly consistent with their traits / preferences, whereas others may have quite different scores contrasting their behaviours and traits / preferences on one or more of the Big Five dimensions. To an extent this is captured in this research in the distinction between BF57 traits / preferences and Great Eight behaviours. However, creating trait / preference measures separate to behavioural measures purely within the realm of personality also has merit. This would enable an exploration of the impact of different combinations on performance at work. In this way, the interaction within a person's personality of their traits / preferences and behaviours could be explored both adaptively and maladaptively.

If such a profiling technology was developed, it could also challenge existing stereotypic thinking about how jobs can be done. It is possible that previous less refined models could turn out with hindsight to have encouraged prejudice towards people with certain traits, which could comfortably be managed in behavioural terms in the workplace. For example, an individual may score high on Neuroticism and be "an anxious worrier" in trait / preference terms, but this may not impact their behaviour or performance at work due to them practising mindfulness.

The BF57 has measured both ends of the Big Five polarities. However, only the O, C, E and A aspects were bifurcated again into adaptive and maladaptive forms. Neuroticism and Emotional Stability were left out as at the time it seemed a conceptual over-reach to measure Neuroticism positively and there is little literature to support this. However, even measured maladaptively in the BF57, Neuroticism did correlate positively ($r = 0.12$) with the competency "use of technology" in this research and this suggests there may be merit in exploring an adaptive side to Neuroticism e.g. it may help individuals spot risks early and be vigilant in the workplace. In certain contexts, Neurotic behaviour can be inspiring or even amusing. For example, could it be that some stand-up comedians base their acts on exploring and sharing their inner neurotic thoughts? Equally, looking at the other end of the

polarity, could a senior executive who is highly emotionally stable, optimistic and confident, become over optimistic and over confident? Could Emotional Stability be expressed in a maladaptive form? These are recommended areas for further research.

This research discussed and defined the terms adaptive and maladaptive in sections 1.7, 4.1.4 and 4.2.3, with adaptive BF57 traits having been created that are located anywhere between evaluatively neutralised and slightly positive in nature, as advocated by Peabody (1967). One interesting idea to research is the possibility of honing this definition to focus on fully neutralised items, and to iteratively remove any items associated with positive valence from the adaptive item creation process. Support for this research idea can be found in Bäckström et al. (2014) who have undertaken a study that provided evidence that the act of neutralising an item does not reduce its variability, but in fact may helpfully increase it due to its new mean being nearer the midpoint of the scale. Bäckström et al. (2014) also presented evidence that neutralising items does not lead to lower criterion validity and can possibly improve construct validity through reducing the correlation between factors. The BF57 could be a helpful instrument to help validate these ideas and balance them against Musek's (2007) perspective that evaluative bias is a legitimate aspect of the Big One and to reduce evaluative bias may make an instrument less useful if the evaluative bias is positively linked to an outcome a practitioner is interested in.

Further research could also explore the notion that Neuroticism may be one root source of maladaptive and also dark side behaviours. In the BF57 three maladaptive scales (C+, A-, O-) have a second highest loading on N+. However, the remaining five maladaptive scales (E+, E-, C-, A+, O+) do not have a second highest loading on N+. This suggests Neuroticism does have a relationship with maladaptive scales. The BF57 Neuroticism measure also correlates positively with 7 of the 11 HDS scales. Both these results indicate this would be a fruitful area for further research.

Finally, further research could explore how the BF57 may be able to function as an instrument for dissecting and assessing the construct validity of existing instruments in a way that other instruments may not be able to, and may well compliment the TDA periodic table analysis. This idea is supported by the greater semantic

coverage of the constituents of personality the BF57 brings, as shown by the periodic table analysis in Table 5-16.

10.6 Conclusion

The first conclusion from this thesis, is that dependent on how they are measured, the different poles of the Big Five dimensions may contain different amounts of social desirability, and that for certain applications, mitigating this is an important issue. Without focusing on this issue, many Big Five instruments risk unintentionally exacerbating evaluative bias if they measure and/or report one end of a polarity more positively than another. Examples of this would include suggesting those high in Extraversion are bold and assertive, yet more Introverted people are timid and shy, or suggesting people high in Conscientiousness are organised and reliable, yet those low are lazy rule breakers. In some contexts, such as pure research, provided the researcher understands the issue, the impact of this bias may be lessened. However, this bias is most concerning when the need for user validity is high, particularly when the test taker is also the test user and there is a need to value all the different test takers' ways of being.

The second conclusion is that one effective way to address the issue of bias, which is the approach adopted in this thesis, is to measure both ends of the Big Five dimensions in ways that will be seen as equally desirable, or at least evaluatively neutral, in the workplace. For example, those high in Extraversion may indeed be bold and assertive, yet more Introverted people may be good at listening before speaking. Dependent on the context, both of these polarities would generally be considered to represent adaptive behaviours in the workplace. Equally, those high in Conscientiousness may well be organised and reliable, yet the opposite polarity can be described as flexible and emergent. Again, in different contexts both polarities may represent adaptive behaviour.

The third conclusion, is that conceptualising maladaptive traits as the more extreme ends of the Big Five ("too much of a good thing") helps explain enablers and blockers to performance at work, without risking pathologizing people who are using psychometrics in organisational settings and not seeking a clinical intervention.

The fourth conclusion, is that the BF57 approach does reduce evaluative bias compared to the TDA and IPIP-NEO, yet also enables the test user to crack open their Big Five dimensions and see their adaptive and maladaptive traits at both ends of the polarities for Openness, Conscientiousness, Extraversion and Agreeableness. In many, but not all, contexts, this brings a user validity benefit.

Finally, the fifth exciting and tentative conclusion, is that the BF57 has explored elements of the periodic table (Woods & Anderson, 2016) potentially less well researched by other top psychometrics, and may have found one element not yet researched elsewhere, namely the blend that leads with Conscientiousness and is supported by Neuroticism. More research is needed to further understand and validate this potential claim.

At the outset of this research a key purpose was “to develop an integrated model of personality through use of inductive, deductive and criterion-centric methods (Burisch, 1986) that measures both ends of each Big Five factor separately” (see section 1.2). The intention was to better understand evaluative bias within the Big Five and to measure how adaptive and maladaptive traits impact performance at work. To do this, the BF57 instrument has been created and its Big Five factor structure fully documented; its convergent and divergent validity analysed with particularly interesting results finding some BF57 scales located in the less researched (or not researched at all) parts of the personality periodic table (Woods & Anderson, 2016); its criterion validity explored casting further light on the complex relationships between ‘bright side’ and ‘dark side’ traits and performance at work; its mitigation of social desirability compared to the TDA and IPIP-NEO quantified and the user validity benefit of valuing all the many different ways of being explored. The numerous ways the findings in this research advance the literature on personality predictor and competency criterion have been discussed. It is hoped that the development of the BF57 and the ideas in this research will stimulate both further theoretical and applied research into understanding how psychometrics can be helpfully applied organisationally in selection and development.

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APPENDICES

Appendix I: The Great Eight Items

Table 11-1: Great Eight Items

Analysing Situations: Demonstrating Analytical Thinking; Solving Complex Problems; Critically Evaluating Information
Creating Concepts: Being Creative and Innovating; Thinking Strategically; Driving Organisational Change
Relating to People: Displaying Good Interpersonal Skills; Exercising Active Listening; Communicating Effectively
Controlling Resources: Leading and Directing Others; Managing People and Resources Effectively; Being Decisive; Making Sound Judgments
Respecting People: Giving Support; Building Team Spirit; Showing Compassion and Being Approachable
Adapting to Demands: Showing Composure; Working Effectively Under Pressure; Dealing with Ambiguity
Delivering Results: Planning and Organising Efficiently; Working Diligently; Completing Tasks on Time
Driving Performance: Having Career Ambition; Setting and Achieving Ambitious Work Objectives; Showing Business Acumen

Appendix II: Item Pool

Table 11-2: Item Pool

Scale	Item	r
O+1.Ada	I am very open to trying new things	0.55
O+1.Ada	I am often first to adopt new trends or approaches	0.60
O+1.Ada	I am often the first to embrace new and alternative ideas	0.66
O+1.Ada	Others may consider my ideas radical and eccentric	0.62
O+1.Ada	I am often the one who instigates radical change	0.66
O+1.Ada	I take risks and push the boundaries	0.61
O+1.Ada	I am a non-conformist	0.57
O+1.Ada	I think doing things the same old way every time is boring	0.36
O+1.Ada	I have strong interests that I absorb myself in	0.30
O+1.Ada	I enjoy being unconventional	0.60
O+1.Ada	I enjoy varying my daily routine	0.34
O+1.Ada	I enjoy challenging convention	0.65
O+1.Ada	I like to challenge the status quo	0.56
O+1.Ada	My ideas are often unconventional and radical	0.71
O+2.Ada	I am original and come up with new ideas	0.74
O+2.Ada	I produce a lot of creative ideas	0.72
O+2.Ada	Others would say that I take a novel approach when solving a problem	0.63
O+2.Ada	I am often the one who sees the wider possibilities	0.67
O+2.Ada	Being able to express my creativity is very important to me	0.61
O+2.Ada	I like to play with new ideas	0.71
O+2.Ada	I am naturally drawn to thinking about the bigger picture	0.59
O+2.Ada	Certain music art or nature really captures my imagination and moves me	0.39
O+2.Ada	I am naturally a source of innovative ideas	0.73
O+2.Ada	I am naturally very imaginative	0.64
O+2.Ada	I am good at thinking outside of the box	0.74
O+3.Ada	I observe trends and patterns not obvious to others	0.54
O+3.Ada	I am good at discussing hypothetical scenarios	0.53
O+3.Ada	I am good at conceptual thinking	0.61
O+3.Ada	I enjoy reading about new theories that challenge my mind set	0.55
O+3.Ada	I enjoy pondering over philosophical issues	0.50
O+3.Ada	I enjoy highly intellectual debates	0.57
O+3.Ada	I seek out opportunities to enrich my general knowledge	0.43
O+3.Ada	I enjoy critically evaluating theories and ideas	0.41
O+3.Ada	I am naturally intellectually curious	0.51
O+3.Ada	I am good at abstract thinking	0.67
O+1.Mal	Others consider my ideas for change as imprudent	0.44
O+1.Mal	I do not see why I should conform and follow the traditional approach	0.38
O+1.Mal	I can push for more radical change than is necessary	0.48
O+1.Mal	Others may consider my ideas as too radical	0.68

Table 11-2 continued

Scale	Item	r
O+2.Mal	When I get caught up in an idea I do not consider the practicalities	0.34
O+2.Mal	My ideas can be so innovative they may appear unrealistic	0.65
O+3.Mal	My ideas sometimes come across as too complex to others	0.63
O+3.Mal	My explanations can be too elaborate and complicated	0.46
O+3.Mal	I can be too intellectual and not consider that people want a simple answer	0.48
O+3.Mal	When I present my ideas to others they may come across as too conceptual and complex	0.64
O-1.Ada	It would take a lot to persuade me to break with tradition and embrace a radical new idea	0.60
O-1.Ada	When working on a task I normally do it the conventional way rather than create my own new process	0.57
O-1.Ada	When others suggest radical ideas, I tend to respond by being practical and down to earth	0.57
O-1.Ada	It would be hard to talk me into doing something radical	0.55
O-1.Ada	I have a healthy respect for tradition and authority	0.36
O-1.Ada	I focus on the current realities rather than future possibilities	0.54
O-1.Ada	When faced with radical change I adopt a cautious approach	0.61
O-1.Ada	I am inclined to do things by the book and avoid new approaches	0.65
O-1.Ada	I tend to be more conservative in my thinking	0.65
O-1.Ada	I am quite predictable	0.47
O-1.Ada	Once I find a way of doing things that works for me I stick to it	0.55
O-1.Ada	I tend to play it safe	0.55
O-1.Ada	My conservative approach means I will not make rash decisions	0.59
O-1.Ada	I normally stick with the tried and tested unless the case for change is overwhelming	0.64
O-1.Ada	Being wary it would be hard to talk me into doing something radical	0.57
O-1.Ada	I am not the one to challenge convention	0.53
O-1.Ada	I can be sceptical of grand ideas	0.44
O-1.Ada	I am grounded by my traditional beliefs and values	0.35
O-1.Ada	Knowing what I stand for is more important than being "open-minded"	0.21
O-1.Ada	I like to stick to what I know	0.59
O-1.Ada	I do not like a lot of change	0.47
O-1.Ada	I prefer stability and familiarity in my routine	0.58
O-1.Ada	I prefer to spend my time in familiar environments	0.45
O-1.Ada	I am a creature of habit and like my routines	0.49
O-1.Ada	I prefer to use tried-and-tested methods	0.57
O-1.Ada	I like to do things the conventional way	0.66
O-2.Ada	I am very realistic and avoid flights of fancy	0.57
O-2.Ada	I tend to stick to the facts and not overestimate	0.52
O-2.Ada	I tend to be quite matter-of-fact and evidence based	0.49
O-2.Ada	I take a realistic view of the possibilities	0.28
O-2.Ada	When presenting information I focus on facts and details	0.49
O-2.Ada	I make decisions after gathering as much facts or information as I can	0.32
O-2.Ada	I focus on specifics rather than the big picture	0.54

Table 11-2 continued

Scale	Item	r
O-2.Ada	I am not particularly sentimental or emotional	0.14
O-2.Ada	I don't find myself daydreaming very often	0.23
O-2.Ada	I do not have many emotional highs and lows	0.14
O-2.Ada	Sometimes I am not sure how I feel	0.15
O-2.Ada	I tend to avoid looking for deep meaning in everyday events	0.28
O-2.Ada	I find it easier to focus on the details rather than the bigger picture	0.50
O-2.Ada	I focus on reality and rarely let my imagination run wild	0.55
O-2.Ada	My ideas tend to be more conventional than novel	0.61
O-2.Ada	I base my decisions on factual reality and rarely trust my intuition	0.40
O-2.Ada	I am not easily emotionally moved	0.17
O-2.Ada	I stick to proven evidence and rarely think outside the box	0.62
O-3.Ada	My practical side would stop me leaping into new things without checking they will work first	0.51
O-3.Ada	Others can find my problem solving pragmatic yet lacking in creativity	0.58
O-3.Ada	I ensure my ideas are practical and in the real-world	0.40
O-3.Ada	I avoid theorising and focus on the here and now	0.42
O-3.Ada	I avoid intellectual debate and focus on the facts	0.51
O-3.Ada	When solving problems, I spend little time in intellectual debate	0.33
O-3.Ada	I am straightforward and not prone to over embellishment	0.34
O-3.Ada	I tend to be a more practical and matter-of-fact individual	0.46
O-3.Ada	I tend to look for practical solutions before contemplating anything "off the wall"	0.61
O-3.Ada	I like people to say literally what they mean and provide plenty of detail	0.32
O-3.Ada	As long as something works in practice I am not concerned about the theory underpinning it	0.24
O-3.Ada	My instinct is to find a quick practical solution rather than probe deeply into an issue	0.23
O-3.Ada	I prefer dealing with simple and clear-cut topics	0.54
O-3.Ada	I prefer to work on practical rather than intellectual problems	0.40
O-3.Ada	I care little about elegant theories only how they work in the real world	0.27
O-3.Ada	I care more about the practical implementation of theories in reality	0.23
O-3.Ada	My pragmatic side tends to curtail my curiosity	0.52
O-3.Ada	I prefer to keep things simple and not get too theoretical	0.33
O-3.Ada	My approach to solving problems is very practical yet may lack a creative spark	0.63
O-1.Mal	I do not like having to listen to radical views that conflict with my way of thinking	0.55
O-1.Mal	I do not like my routine disturbed by other people's "good ideas"	0.54
O-1.Mal	I really do not like to break with tradition	0.55
O-1.Mal	It can be difficult to convince me to change my mind	0.29
O-1.Mal	I tend to be restricted in the possibilities I consider	0.55
O-1.Mal	I am a creature of habit and dislike change	0.62
O-1.Mal	I can be sceptical of change	0.54
O-1.Mal	I can be to too set in my ways	0.52
O-1.Mal	It is difficult for me to adapt to radical change	0.54

Table 11-2 continued

Scale	Item	r
O-2.Mal	I think daydreaming is a waste of time	0.26
O-2.Mal	I can struggle to imagine things without knowing the details	0.52
O-2.Mal	I can struggle to see the bigger picture	0.53
O-2.Mal	I can lack the imagination to see wider possibilities	0.57
O-3.Mal	I lose interest when people start talking about theories and concepts	0.43
O-3.Mal	I get bored when people talk at a theoretical level	0.38
O-3.Mal	I am so practical that I find it difficult to consider hypothetical scenarios	0.55
O-3.Mal	I often focus on the problems rather than the possibilities	0.50
O-3.Mal	I have difficulty engaging in abstract discussion	0.56
C+1.Ada	I can be relied on to always follow through on my commitments	0.56
C+1.Ada	I meet my commitments in a timely manner	0.61
C+1.Ada	Other people trust me to always deliver on time	0.55
C+1.Ada	I always honour my commitments on time	0.54
C+1.Ada	It is important to me to always follow through on my commitments	0.46
C+1.Ada	It is important to me to stick with a task until it is finished	0.58
C+1.Ada	I naturally see things through to completion	0.64
C+2.Ada	I am good at planning things in detail	0.61
C+2.Ada	When working on a task I am structured and methodical	0.64
C+2.Ada	When working on a task I am meticulous	0.55
C+2.Ada	I like to do jobs carefully so they won't need to be done again	0.54
C+2.Ada	Attention to detail is a natural strength of mine	0.48
C+2.Ada	I like to plan things carefully	0.58
C+2.Ada	I am a highly organised individual	0.70
C+3.Ada	I waste no time getting started on my tasks	0.57
C+3.Ada	I am good at pacing my work to avoid last-minute pressure	0.59
C+3.Ada	I work purposefully towards the goals I have set and am not easily distracted	0.63
C+3.Ada	I am a highly productive and efficient individual	0.52
C+3.Ada	I like to be very clear on what I need to get done at the outset	0.48
C+3.Ada	I enjoy establishing a clear set of goals	0.49
C+3.Ada	I like to set clear objectives for my projects at the beginning	0.52
C+3.Ada	I start tasks early to avoid the stress of having to do things at the last minute	0.62
C+1.Mal	My reliable side prevents me acting spontaneously	0.56
C+1.Mal	My commitment focus can prevent me from adapting to changing circumstances	0.53
C+1.Mal	My focus on my commitments can make it difficult for me to make spontaneous decisions	0.61
C+2.Mal	I am unwilling to deviate from rules and common procedure	0.43
C+2.Mal	I can be rigid in sticking to formal processes	0.55
C+2.Mal	I can stick too rigidly to a plan	0.59
C+3.Mal	I become impatient with others who leave things to the last minute	0.45
C+3.Mal	I find it difficult to work without formal goals and objectives	0.50

Table 11-2 continued

Scale	Item	r
C+3.Mal	I find it difficult to work with those who like to work last-minute	0.50
C-1.Ada	I am relaxed about time management	0.58
C-1.Ada	I use last-minute deadline pressure to spur me into action	0.47
C-1.Ada	I often make spontaneous or last-minute decisions	0.62
C-1.Ada	I often act on the spur of the moment	0.61
C-1.Ada	I make open-ended commitments to see what emerges	0.50
C-1.Ada	I like to let the adrenaline of last-minute pressure spur me into action	0.46
C-1.Ada	I like to make decisions immediately	0.18
C-1.Ada	My natural inclination is to act spontaneously	0.55
C-1.Ada	I prefer to take an informal approach to time management	0.58
C-1.Ada	I prefer to work without formal deadlines	0.42
C-2.Ada	I tend to keep my plans informal in order to keep my options open	0.61
C-2.Ada	I avoid meticulous planning	0.46
C-2.Ada	I don't worry about the minor details of a plan	0.40
C-2.Ada	I work in a flexible unstructured way	0.64
C-2.Ada	I work well with ambiguity and lack of structure	0.48
C-2.Ada	Working in a flexible unstructured way is a real strength of mine	0.55
C-2.Ada	I enjoy working without a formal plan	0.62
C-2.Ada	I prefer to make very open plans that can be changed easily	0.56
C-3.Ada	I am more productive working without formal goals	0.59
C-3.Ada	I let my goals and objectives emerge naturally	0.44
C-3.Ada	I tend to adapt my objectives as I go along	0.49
C-3.Ada	I naturally adopt a laid-back approach to my work	0.35
C-3.Ada	When working I prefer to let my objectives emerge as I go along	0.57
C-3.Ada	I enjoy working without formal objectives	0.49
C-1.Mal	I can neglect my commitments and run out of time	0.66
C-1.Mal	My spontaneous approach can cause me to change my plans at the last minute	0.50
C-1.Mal	My spontaneous side can impact my timekeeping	0.58
C-2.Mal	My lack of organisation can frustrate others	0.68
C-2.Mal	My lack of organisation can affect my performance	0.67
C-2.Mal	At times I can appear disorganised	0.68
C-3.Mal	At times I lack a clear goal focus	0.58
C-3.Mal	I can lack the determination needed to pursue my goals	0.41
C-3.Mal	I can be so adaptable that I lose sight of my original objectives	0.52
E+1.Ada	I am persuasive and convincing in a group	0.58
E+1.Ada	I gravitate towards leadership roles	0.63
E+1.Ada	I take responsibility for leading projects with minimal direction	0.42
E+1.Ada	I am very effective at taking the initiative in a group	0.65
E+1.Ada	Colleagues often look to me for direction or to make key decisions	0.48

Table 11-2 continued

Scale	Item	r
E+1.Ada	I am comfortable telling people what to do	0.53
E+1.Ada	I prefer to be the one leading others	0.56
E+1.Ada	I am naturally inclined to step forward and lead the group	0.68
E+2.Ada	My high level of enthusiasm invigorates others	0.67
E+2.Ada	I show excitement easily	0.47
E+2.Ada	I show a lot of energy and enthusiasm	0.69
E+2.Ada	I am naturally full of energy	0.61
E+2.Ada	I am naturally lively and expressive	0.66
E+2.Ada	I enjoy being the centre of attention	0.50
E+3.Ada	I am an outgoing and gregarious person	0.68
E+3.Ada	I actively maintain a wide social network	0.54
E+3.Ada	I make new friends easily	0.59
E+3.Ada	I find it easy to strike up conversation with strangers	0.60
E+3.Ada	I enjoy chatting to people I have not met before	0.58
E+3.Ada	Interacting with a lot of people energises me	0.60
E+1.Mal	I dislike being managed by others	0.23
E+1.Mal	I don't like being told what to do	0.21
E+1.Mal	My desire to take charge can be overbearing for others	0.56
E+1.Mal	I can take charge in a group even when somebody else is leading it	0.38
E+1.Mal	I have a tendency to take over group discussions	0.59
E+2.Mal	I have a tendency to talk too much	0.59
E+2.Mal	My enthusiasm can be too strong for those around me	0.60
E+2.Mal	My high energy levels can overwhelm other people	0.61
E+3.Mal	I can socialise too much	0.42
E+3.Mal	My social and talkative nature can be distracting for other people	0.61
E+3.Mal	I can be too outgoing and talkative	0.69
E-1.Ada	I tend to let others do more of the talking in meetings	0.66
E-1.Ada	I am better at discussing my ideas at an individual rather than group level	0.54
E-1.Ada	I spend more time listening to others in group discussions	0.57
E-1.Ada	I don't enjoy telling people what to do	0.42
E-1.Ada	I don't enjoy directly controlling what a group does	0.44
E-1.Ada	I don't enjoy directing others	0.43
E-1.Ada	I prefer to work independently	0.29
E-1.Ada	I like to listen to others first before giving my view	0.38
E-2.Ada	Others may view me as reserved	0.75
E-2.Ada	Others see me as contained and low-key	0.68
E-2.Ada	I come across as rather measured and contained	0.59
E-2.Ada	I am not naturally that expressive	0.55
E-2.Ada	I naturally contain my excitement and emotions	0.47

Table 11-2 continued

Scale	Item	r
E-3.Ada	I am naturally more quiet and introspective	0.76
E-3.Ada	I am hesitant to approach people I do not know	0.60
E-3.Ada	I am reserved when I meet new people	0.67
E-3.Ada	It takes me a while to be myself around new people	0.63
E-3.Ada	I only speak when I have considered what I want to say	0.51
E-3.Ada	I need to take time to think before speaking up in a group	0.62
E-1.Mal	Meetings may finish without me having given my opinion	0.60
E-1.Mal	I can be so focused on listening that I do not contribute myself	0.57
E-1.Mal	Often I just listen and don't exert any influence in a group	0.60
E-1.Mal	I take a back seat in group discussions	0.63
E-2.Mal	I can appear so serious that I may look unhappy to others	0.61
E-2.Mal	I can be difficult to read	0.43
E-2.Mal	I can appear unexpressive	0.58
E-2.Mal	My serious demeanour can be mistaken for a lack of enthusiasm	0.59
E-3.Mal	I often hold back in social situations	0.70
E-3.Mal	I am nervous about meeting new people	0.59
E-3.Mal	I am quiet in group situations	0.73
E-3.Mal	My quiet nature can make me appear aloof	0.68
E-3.Mal	I can appear quiet and detached (in social situations)	0.74
A+1.Ada	My instinct is to show sensitivity for the feelings of others	0.65
A+1.Ada	I show concern for the feelings of others	0.61
A+1.Ada	I have a lot of empathy for other people	0.66
A+1.Ada	I am very considerate towards others	0.67
A+1.Ada	I easily show sympathy for the concerns of others	0.66
A+1.Ada	I am gentle and tenderminded when dealing with others	0.62
A+1.Ada	My instinct is to show empathy rather than criticise	0.66
A+1.Ada	I am naturally very empathetic towards others	0.61
A+2.Ada	I prioritise getting along well with others	0.51
A+2.Ada	I tend to see the best in people	0.49
A+2.Ada	I go out of my way to help others	0.41
A+2.Ada	I talk more about other people’s talents than my own	0.35
A+2.Ada	I am humble about my achievements and focus more on praising others	0.41
A+2.Ada	I put the collective interests of the team before my own	0.39
A+2.Ada	I cooperate very easily with others	0.43
A+2.Ada	I try and actively maintain good relationships with my colleagues	0.41
A+2.Ada	I am generous with my time when it comes to helping or supporting others	0.37
A+2.Ada	I am a naturally forgiving person	0.36
A+2.Ada	I am naturally trusting of others	0.35
A+3.Ada	When debating things with others I am careful to avoid causing offence	0.53

Table 11-2 continued

Scale	Item	r
A+3.Ada	In an argument I tend to be the one who compromises	0.45
A+3.Ada	I am naturally inclined to avoid arguments	0.41
A+3.Ada	I don't enjoy heated arguments	0.35
A+3.Ada	I am naturally inclined to avoid conflict	0.43
A+3.Ada	I naturally try to seek consensus	0.49
A+1.Mal	My empathy for others can cloud my judgement	0.50
A+1.Mal	I find it difficult to say "No" to people who need my help	0.43
A+1.Mal	My consideration for others can lead them to take advantage of me	0.70
A+2.Mal	I can be too modest and not get the recognition I deserve	0.35
A+2.Mal	I am so trusting that people sometimes take advantage of me	0.66
A+2.Mal	People can exploit my generous and helpful nature	0.63
A+3.Mal	I have a tendency to avoid confrontation	0.52
A+3.Mal	I can be too diplomatic and not say what I really think	0.52
A+3.Mal	I often avoid raising contentious issues in my desire to keep the peace	0.47
A-1.Ada	I believe arguing my case is more important than worrying about people's feelings	0.53
A-1.Ada	I tend to leave emotion and sentiment out of the decision-making process	0.41
A-1.Ada	I take a hard-nosed and logical approach when making decisions	0.51
A-1.Ada	I make decisions based on logic and am rarely swayed by emotions	0.41
A-1.Ada	I am not interested in hearing other people's problems	0.19
A-1.Ada	I prefer to keep emotion and sentiment out of the decision-making process	0.40
A-1.Ada	I prefer to make decisions using logic rather than the need to show sensitivity towards others	0.55
A-2.Ada	I am naturally very competitive with others	0.61
A-2.Ada	I outsmart others to achieve my goals	0.44
A-2.Ada	I am shrewd when it comes to handling people	0.11
A-2.Ada	I strive to outperform my colleagues	0.52
A-2.Ada	I am competitive with my colleagues	0.57
A-2.Ada	I would enjoy working in a competitive environment	0.60
A-2.Ada	I enjoy competitive activities	0.54
A-2.Ada	I am motivated by a sense of competition	0.55
A-3.Ada	I am a tough negotiator and don't give in easily to others	0.52
A-3.Ada	I am firm and direct with others	0.52
A-3.Ada	I make my opinions known in a frank and candid manner	0.43
A-3.Ada	I can really enjoy a tough argument	0.45
A-3.Ada	I prefer to be very direct with others	0.47
A-3.Ada	I like to be very direct and candid when expressing my views	0.44
A-1.Mal	I can be so focused on the logic of an argument that I hurt people's feelings	0.65
A-1.Mal	My need to be objective can make me appear uncaring	0.52
A-1.Mal	My need to be objective when making decisions can make me seem insensitive	0.54
A-2.Mal	At times I can come across as competitive and egotistical	0.64
A-2.Mal	I use my shrewdness to get people to do what I want	0.25

Table 11-2 continued

Scale	Item	r
A-2.Mal	I want to win even if it means other people lose out	0.49
A-2.Mal	My colleagues may view me as very competitive	0.57
A-2.Mal	My desire to win can be overbearing for others	0.61
A-3.Mal	I can be so direct that I upset people	0.67
A-3.Mal	When challenging others I can appear aggressive	0.57
A-3.Mal	I can come across as insensitive and blunt	0.64
N+1.Mal	I get quite visibly stressed	0.63
N+1.Mal	I get flustered in response to set-backs	0.67
N+1.Mal	Others can easily tell if I am stressed	0.36
N+1.Mal	Often I can feel paralysed by stress	0.65
N+1.Mal	I become stressed easily	0.76
N+1.Mal	I have difficulty managing my stress levels	0.70
N+1.Mal	I can feel overwhelmed easily	0.66
N+2.Mal	I am very concerned about others perception of me	0.42
N+2.Mal	I often undersell myself	0.32
N+2.Mal	It can be difficult to convince me to take on tasks outside my comfort zone	0.50
N+2.Mal	My lack of self-confidence holds me back	0.64
N+2.Mal	I avoid taking on challenges outside my comfort zone	0.49
N+2.Mal	I am uncomfortable making big decisions without assurance from others	0.44
N+2.Mal	I need a lot of encouragement to take on new challenges	0.50
N+2.Mal	I get self-conscious easily	0.55
N+2.Mal	I am afraid of failure	0.61
N+2.Mal	I feel embarrassed easily	0.54
N+2.Mal	I get nervous around figures of authority	0.55
N+2.Mal	I often doubt my abilities	0.66
N+2.Mal	My fear of failure prevents me from taking on greater challenges	0.61
N+2.Mal	I sometimes feel like a failure	0.59
N+2.Mal	I often dwell on my failings	0.63
N+2.Mal	I dislike taking on challenges outside my comfort zone	0.40
N+2.Mal	I tend to be very hard on myself	0.39
N+3.Mal	I am quick-tempered	0.45
N+3.Mal	I get easily irritated with people	0.54
N+3.Mal	My temper can get the better of me	0.41
N+3.Mal	I get visibly impatient with others	0.33
N+3.Mal	I get irritated when things don’t go to plan	0.54
N+3.Mal	I am prone to mood swings	0.64
N+3.Mal	I can overreact to setbacks or challenges	0.61
N+3.Mal	I find unexpected complications very frustrating	0.60
N+3.Mal	Small setbacks can put me in a bad mood	0.68
N+3.Mal	Little things annoy me	0.58

Table 11-2 continued

Scale	Item	r
N+3.Mal	I can find small setbacks quite frustrating	0.69
N+3.Mal	My mood fluctuates frequently throughout the day	0.60
N+3.Mal	I am easily agitated	0.59
N+3.Mal	I can find it difficult to control my anger	0.47
N+3.Mal	I get frustrated easily	0.60
N+4.Mal	Others would describe me as a worrier	0.68
N+4.Mal	I can exaggerate problems	0.50
N+4.Mal	I am apprehensive of change	0.53
N+4.Mal	I become dispirited easily	0.69
N+4.Mal	My apprehensive side can make me nervous of change	0.67
N+4.Mal	I can focus too heavily on what could go wrong	0.65
N+4.Mal	I can feel unhappy for no clear reason	0.59
N+4.Mal	I wish I could spend less time worrying	0.68
N+4.Mal	I ruminate about things that have happened	0.52
N+4.Mal	I often feel on edge	0.66
N+4.Mal	I worry a lot about what could go wrong	0.68
N+4.Mal	I am an anxious person	0.70
N+4.Mal	I often feel nervous and tense	0.71
N+4.Mal	I am a natural worrier	0.65
N-1.Ada	I am able to remain composed when under stress	0.57
N-1.Ada	I handle daily pressures without appearing stressed	0.57
N-1.Ada	I stay calm in pressure situations	0.62
N-1.Ada	I retain my composure in high pressure situations	0.59
N-1.Ada	I don’t get stressed too easily	0.61
N-1.Ada	I feel capable of handling the stresses in my life	0.56
N-1.Ada	I feel I have high tolerance for stress	0.56
N-2.Ada	I appear confident in my abilities	0.45
N-2.Ada	I come across as confident and self-assured	0.42
N-2.Ada	I embrace new challenges	0.45
N-2.Ada	I am confident that I can achieve my goals	0.53
N-2.Ada	I have a lot of self-belief	0.53
N-2.Ada	I believe in myself and what I can do	0.54
N-3.Ada	I avoid taking my anger out on others	0.30
N-3.Ada	I rarely take my frustration out on others	0.39
N-3.Ada	I am very patient with others	0.31
N-3.Ada	If I am upset or angry I make my feelings known in a calm way	0.40
N-3.Ada	I keep my composure when others get angry	0.47
N-3.Ada	Others would describe me as calm and even-tempered	0.38
N-3.Ada	I am naturally even-tempered	0.54
N-3.Ada	It takes a lot for me to feel angry or annoyed	0.52

Table 11-2 continued

Scale	Item	r
N-3.Ada	It takes a lot to frustrate me	0.48
N-4.Ada	Others see me as optimistic and positive	0.57
N-4.Ada	I adopt a positive 'can do' attitude	0.57
N-4.Ada	I am not easily discouraged	0.54
N-4.Ada	I avoid coming across as negative or doubtful	0.32
N-4.Ada	I am good at staying upbeat and optimistic	0.65
N-4.Ada	I believe things will work out fine in the end	0.43
N-4.Ada	I am naturally optimistic	0.64
N-4.Ada	Even when things are tough I don't let it get me down	0.61
N-4.Ada	I tend to see the positive side of things	0.59

Note: N = 2,506; Scale code first two digits O+ Open, O- Pragmatic, C+ Conscientious, C- Flexible, E+ Extraverted, E- Introverted, A+ Agreeable, A- Direct, N+ Neurotic, N- Emotionally Stable; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive; r is the corrected item-to-scale correlation against the eighteen scales

Appendix III: BF57 Items by Aspect

Table 11-3: BF57 Openness Items

Aspect	Code	Adaptive or Maladaptive	Item
Openness Plus	O+1	Adaptive	My ideas are often unconventional and radical
Openness Plus	O+2	Adaptive	I am good at thinking outside of the box
Openness Plus	O+3	Adaptive	I am good at abstract thinking
Openness Plus	O+1	Maladaptive	Others may consider my ideas as too radical
Openness Plus	O+2	Maladaptive	My ideas can be so innovative they may appear unrealistic
Openness Plus	O+3	Maladaptive	When I present my ideas to others they may come across as too conceptual and complex
Openness Minus	O-1	Adaptive	I like to do things the conventional way
Openness Minus	O-2	Adaptive	I stick to proven evidence and rarely think outside the box
Openness Minus	O-3	Adaptive	My approach to solving problems is very practical yet may lack a creative spark
Openness Minus	O-1	Maladaptive	I can find it difficult to be open-minded to more radical ideas
Openness Minus	O-2	Maladaptive	I can lack the imagination to see wider possibilities
Openness Minus	O-3	Maladaptive	I have difficulty engaging in abstract discussion

Note: Code first two digits O+ Open, O- Pragmatic; Code third digit is the category number.

Table 11-4: BF57 Conscientiousness Items

Aspect	Code	Adaptive or Maladaptive	Item
Conscientiousness Plus	C+1	Adaptive	I naturally see things through to completion
Conscientiousness Plus	C+2	Adaptive	I am a highly organised individual
Conscientiousness Plus	C+3	Adaptive	I start tasks early to avoid the stress of having to do things at the last minute
Conscientiousness Plus	C+1	Maladaptive	My focus on my commitments can make it difficult for me to make spontaneous decisions
Conscientiousness Plus	C+2	Maladaptive	I can stick too rigidly to a plan
Conscientiousness Plus	C+3	Maladaptive	I find it difficult to work with those who like to work last-minute
Conscientiousness Minus	C-1	Adaptive	I am relaxed about time management
Conscientiousness Minus	C-2	Adaptive	I tend to keep my plans informal in order to keep my options open
Conscientiousness Minus	C-3	Adaptive	I am more productive working without formal goals
Conscientiousness Minus	C-1	Maladaptive	I can neglect my commitments and run out of time
Conscientiousness Minus	C-2	Maladaptive	My lack of organisation can frustrate others
Conscientiousness Minus	C-3	Maladaptive	At times I lack a clear goal focus

Note: Code first two digits C+ Conscientious, C- Flexible; Code third digit is the category number.

Table 11-5: BF57 Extraversion Items

Aspect	Code	Adaptive or Maladaptive	Item
Extraversion Plus	E+1	Adaptive	I am naturally inclined to step forward and lead the group
Extraversion Plus	E+2	Adaptive	I am naturally lively and expressive
Extraversion Plus	E+3	Adaptive	I am an outgoing and gregarious person
Extraversion Plus	E+1	Maladaptive	I have a tendency to take over group discussions
Extraversion Plus	E+2	Maladaptive	My high energy levels can overwhelm other people
Extraversion Plus	E+3	Maladaptive	I can be too outgoing and talkative
Extraversion Minus	E-1	Adaptive	I tend to let others do more of the talking in meetings
Extraversion Minus	E-2	Adaptive	Others may view me as reserved
Extraversion Minus	E-3	Adaptive	I am naturally more quiet and introspective
Extraversion Minus	E-1	Maladaptive	I take a back seat in group discussions
Extraversion Minus	E-2	Maladaptive	My serious demeanour can be mistaken for a lack of enthusiasm
Extraversion Minus	E-3	Maladaptive	I can appear quiet and detached (in social situations)

Note: Code first two digits E+ Extraverted, E- Introverted; Code third digit is the category number.

Table 11-6: BF57 Agreeableness Items

Aspect	Code	Adaptive or Maladaptive	Item
Agreeableness Plus	A+1	Adaptive	My instinct is to show sensitivity for the feelings of others
Agreeableness Plus	A+2	Adaptive	I prioritise getting along well with others
Agreeableness Plus	A+3	Adaptive	When debating things with others I am careful to avoid causing offence
Agreeableness Plus	A+1	Maladaptive	My empathy for others can cloud my judgement
Agreeableness Plus	A+3	Maladaptive	I have a tendency to avoid confrontation
Agreeableness Plus	A+3	Maladaptive	I can be too diplomatic and not say what I really think
Agreeableness Minus	A-1	Adaptive	I believe arguing my case is more important than worrying about people's feelings
Agreeableness Minus	A-2	Adaptive	I am naturally very competitive with others
Agreeableness Minus	A-3	Adaptive	I am a tough negotiator and don't give in easily to others
Agreeableness Minus	A-3	Adaptive	I am firm and direct with others
Agreeableness Minus	A-1	Maladaptive	I can be so focused on the logic of an argument that I hurt people's feelings
Agreeableness Minus	A-2	Maladaptive	At times I can come across as competitive and egotistical
Agreeableness Minus	A-3	Maladaptive	I can be so direct that I upset people

Note: Code first two digits A+ Agreeable, A- Direct; Code third digit is the category number.

Table 11-7: BF57 Neuroticism Items

Aspect	Code	Adaptive or Maladaptive	Item
Neuroticism Plus	N+1	Maladaptive	I become stressed easily
Neuroticism Plus	N+2	Maladaptive	I often doubt my abilities
Neuroticism Plus	N+3	Maladaptive	I am prone to mood swings
Neuroticism Plus	N+4	Maladaptive	I am an anxious person
Neuroticism Minus	N-1	Adaptive	I stay calm in pressure situations
Neuroticism Minus	N-2	Adaptive	I believe in myself and what I can do
Neuroticism Minus	N-3	Adaptive	I am naturally even-tempered
Neuroticism Minus	N-4	Adaptive	Even when things are tough I don't let it get me down

Note: Code first two digits N+ Neurotic, N- Emotionally Stable; Code third digit is the category number.

Appendix IV: BF57 Item Alphas and Factor Analysis

Table 11-8: BF57 Openness Item Alphas and Factor Analysis

Scale	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Not Deleted	Factor 1 - Extraversion	Factor 2 - Openness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Conscientiousness
O+1.Ada	My ideas are often unconventional and radical	.56	.56	.75	-.05	.73	.16	.02	.16
O+2.Ada	I am good at thinking outside of the box	.61	.61	.75	-.14	.75	.08	-.16	.04
O+3.Ada	I am good at abstract thinking	.56	.56	.75	.01	.72	.05	-.08	.04
O+1.Mal	Others may consider my ideas as too radical	.68	.68	.77	-.03	.65	.28	.17	.19
O+2.Mal	My ideas can be so innovative they may appear unrealistic	.62	.62	.77	-.06	.69	.16	.13	.20
O+3.Mal	When I present my ideas to others they may come across as too conceptual and complex	.51	.51	.77	.17	.51	.17	.27	.12
O-1.Ada	I like to do things the conventional way	.53	.53	.74	.19	-.58	-.05	.13	-.19
O-2.Ada	I stick to proven evidence and rarely think outside the box	.60	.60	.74	.20	-.68	.01	.18	-.08
O-3.Ada	My approach to solving problems is very practical yet may lack a creative spark	.58	.58	.74	.18	-.67	.07	.13	-.09
O-1.Mal	I can find it difficult to be open-minded to more radical ideas	.51	.51	.68	.15	-.59	.03	.23	-.13
O-2.Mal	I can lack the imagination to see wider possibilities	.49	.49	.68	.16	-.63	.04	.21	-.05
O-3.Mal	I have difficulty engaging in abstract discussion	.50	.50	.68	.15	-.60	-.04	.19	-.04

Note: N = 2,506; Scale code first two digits O+ Open, O- Pragmatic; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive.

Table 11-9: BF57 Conscientiousness Item Alphas and Factor Analysis

Scale	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Not Deleted	Factor 1 - Extraversion	Factor 2 - Openness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Conscientiousness
C+1.Ada	I naturally see things through to completion	.48	.48	.70	.02	-.09	.04	-.13	-.60
C+2.Ada	I am a highly organised individual	.55	.55	.70	.03	-.06	.05	-.09	-.75
C+3.Ada	I start tasks early to avoid the stress of having to do things at the last minute	.52	.52	.70	.06	-.02	-.02	.01	-.71
C+1.Mal	My focus on my commitments can make it difficult for me to make spontaneous decisions	.45	.45	.61	.22	-.27	-.02	.32	-.38
C+2.Mal	I can stick too rigidly to a plan	.45	.45	.61	.24	-.27	.16	.36	-.35
C+3.Mal	I find it difficult to work with those who like to work last-minute	.37	.37	.61	.13	-.07	.05	.25	-.60
C-1.Ada	I am relaxed about time management	.45	.45	.64	.02	.15	-.01	-.08	.64
C-2.Ada	I tend to keep my plans informal in order to keep my options open	.47	.47	.64	.06	.19	-.05	-.01	.55
C-3.Ada	I am more productive working without formal goals	.43	.43	.64	.01	.21	.02	-.03	.49
C-1.Mal	I can neglect my commitments and run out of time	.56	.56	.72	.01	.06	.05	.31	.63
C-2.Mal	My lack of organisation can frustrate others	.54	.54	.72	-.01	.10	.01	.15	.74
C-3.Mal	At times I lack a clear goal focus	.51	.51	.72	.13	-.03	-.09	.34	.58

Note: N = 2,506; Scale code first two digits C+ Conscientious, C- Flexible; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive.

Table 11-10: BF57 Extraversion Item Alphas and Factor Analysis

Scale	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Not Deleted	Factor 1 - Extraversion	Factor 2 - Openness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Conscientiousness
E+1.Ada	I am naturally inclined to step forward and lead the group	.42	.42	.73	-.50	.24	.28	-.23	-.12
E+2.Ada	I am naturally lively and expressive	.63	.63	.73	-.75	.18	-.03	-.01	.01
E+3.Ada	I am an outgoing and gregarious person	.63	.63	.73	-.78	.08	.00	-.04	.06
E+1.Mal	I have a tendency to take over group discussions	.47	.47	.72	-.47	.16	.43	.11	.02
E+2.Mal	My high energy levels can overwhelm other people	.56	.56	.72	-.52	.24	.25	.12	.01
E+3.Mal	I can be too outgoing and talkative	.60	.60	.72	-.68	.11	.14	.21	.10
E-1.Ada	I tend to let others do more of the talking in meetings	.54	.54	.79	.62	-.12	-.30	.15	.01
E-2.Ada	Others may view me as reserved	.70	.70	.79	.81	-.06	-.04	.08	-.06
E-3.Ada	I am naturally more quiet and introspective	.69	.69	.79	.81	.00	-.11	.09	-.04
E-1.Mal	I take a back seat in group discussions	.44	.44	.68	.59	-.18	-.21	.19	.06
E-2.Mal	My serious demeanour can be mistaken for a lack of enthusiasm	.48	.48	.68	.60	-.11	.23	.20	-.02
E-3.Mal	I can appear quiet and detached (in social situations)	.58	.58	.68	.78	.00	.05	.13	-.01

Note: N = 2,506; Scale code first two digits E+ Extraverted, E- Introverted; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive.

Table 11-11: BF57 Agreeableness Item Alphas and Factor Analysis

Scale	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Not Deleted	Factor 1 - Extraversion	Factor 2 - Openness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Conscientiousness
A+1.Ada	My instinct is to show sensitivity for the feelings of others	.44	.44	.61	-.13	.08	-.62	.07	-.03
A+2.Ada	I prioritise getting along well with others	.42	.42	.61	-.20	.03	-.50	.07	-.01
A+3.Ada	When debating things with others I am careful to avoid causing offence	.41	.41	.61	.16	-.08	-.64	.06	-.09
A+1.Mal	My empathy for others can cloud my judgement	.38	.38	.65	-.05	.02	-.41	.43	.14
A+3.Mal	I have a tendency to avoid confrontation	.48	.48	.65	.28	-.11	-.52	.22	.03
A+3.Mal	I can be too diplomatic and not say what I really think	.53	.53	.65	.27	-.06	-.53	.22	.08
A-1.Ada	I believe arguing my case is more important than worrying about people's feelings	.43	.43	.63	.00	.04	.69	-.02	.01
A-2.Ada	I am naturally very competitive with others	.35	.35	.63	-.20	.03	.43	-.04	-.07
A-3.Ada	I am a tough negotiator and don't give in easily to others	.46	.46	.63	-.12	.12	.52	-.20	-.09
A-3.Ada	I am firm and direct with others	.44	.44	.63	-.18	.09	.56	-.18	-.15
A-1.Mal	I can be so focused on the logic of an argument that I hurt people's feelings	.62	.62	.74	.09	.04	.72	.17	.01
A-2.Mal	At times I can come across as competitive and egotistical	.46	.46	.74	-.19	.12	.60	.14	.01
A-3.Mal	I can be so direct that I upset people	.64	.64	.74	-.02	.11	.76	.17	.03

Note: N = 2,506; Scale code first two digits A+ Agreeable, A- Direct; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive.

Table 11-12: BF57 Neuroticism Item Alphas and Factor Analysis

Scale	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Not Deleted	Factor 1 - Extraversion	Factor 2 - Openness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Conscientiousness
N+1.Mal	I become stressed easily	.69	.69	.79	.10	-.06	-.09	.76	.00
N+2.Mal	I often doubt my abilities	.54	.54	.79	.19	-.13	-.19	.63	.11
N+3.Mal	I am prone to mood swings	.54	.54	.79	.03	.01	.10	.71	.09
N+4.Mal	I am an anxious person	.65	.65	.79	.17	-.04	-.11	.69	-.07
N-1.Ada	I stay calm in pressure situations	.48	.58	.66	.09	.16	.06	-.59	-.07
N-2.Ada	I believe in myself and what I can do	.41	.41	.66	-.16	.21	.23	-.53	-.11
N-3.Ada	I am naturally even-tempered	.38	.38	.66	.14	.01	-.25	-.57	-.01
N-4.Ada	Even when things are tough I don’t let it get me down	.52	.52	.66	-.08	.15	.11	-.60	-.01

Note: N = 2,506; Scale code first two digits N+ Neurotic, N- Emotionally Stable; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive.

Appendix V: BF57 Item to Big Five Correlations

Table 11-13: BF57 Openness Item Correlations with Big Five Dimensions

Scale	Item	O - Openness	C - Conscientiousness	E - Extraversion	A - Agreeableness	N - Neuroticism
O+1.Ada	My ideas are often unconventional and radical	.75**	-.28**	.21**	-.20**	-.11**
O+2.Ada	I am good at thinking outside of the box	.75**	-.20**	.28**	-.18**	-.25**
O+3.Ada	I am good at abstract thinking	.72**	-.18**	.15**	-.12**	-.16**
O+1.Mal	Others may consider my ideas as too radical	.68**	-.28**	.19**	-.26**	-.02
O+2.Mal	My ideas can be so innovative they may appear unrealistic	.72**	-.31**	.21**	-.17**	-.05*
O+3.Mal	When I present my ideas to others they may come across as too conceptual and complex	.51**	-.19**	-.02	-.11**	.10**
O-1.Ada	I like to do things the conventional way	-.64**	.29**	-.27**	.15**	.15**
O-2.Ada	I stick to proven evidence and rarely think outside the box	-.70**	.23**	-.30**	.12**	.22**
O-3.Ada	My approach to solving problems is very practical yet may lack a creative spark	-.70**	.23**	-.27**	.07**	.17**
O-1.Mal	I can find it difficult to be open-minded to more radical ideas	-.64**	.24**	-.25**	.10**	.23**
O-2.Mal	I can lack the imagination to see wider possibilities	-.65**	.19**	-.25**	.09**	.23**
O-3.Mal	I have difficulty engaging in abstract discussion	-.64**	.16**	-.26**	.14**	.23**

*Note: N = 2,506; Scale code first two digits O+ Open, O- Pragmatic; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).*

Table 11-14: BF57 Conscientiousness Item Correlations with Big Five Dimensions

Scale	Item	O - Openness	C - Conscientiousness	E - Extraversion	A - Agreeableness	N - Neuroticism
C+1.Ada	I naturally see things through to completion	-.18**	.60**	-.03	-.07**	-.15**
C+2.Ada	I am a highly organised individual	-.18**	.73**	-.03	-.08**	-.13**
C+3.Ada	I start tasks early to avoid the stress of having to do things at the last minute	-.16**	.69**	-.07**	.00	-.06**
C+1.Mal	My focus on my commitments can make it difficult for me to make spontaneous decisions	-.36**	.47**	-.26**	.12**	.23**
C+2.Mal	I can stick too rigidly to a plan	-.34**	.44**	-.26**	-.03	.26**
C+3.Mal	I find it difficult to work with those who like to work last-minute	-.21**	.61**	-.14**	-.02	.15**
C-1.Ada	I am relaxed about time management	.24**	-.66**	.04	.03	-.05*
C-2.Ada	I tend to keep my plans informal in order to keep my options open	.24**	-.58**	.00	.07**	-.01
C-3.Ada	I am more productive working without formal goals	.26**	-.54**	.05**	-.01	-.03
C-1.Mal	I can neglect my commitments and run out of time	.14**	-.62**	.00	.04	.25**
C-2.Mal	My lack of organisation can frustrate others	.21**	-.73**	.03	.04*	.13**
C-3.Mal	At times I lack a clear goal focus	.02	-.56**	-.14**	.18**	.31**

*Note: N = 2,506; Scale code first two digits C+ Conscientious, C- Flexible; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).*

Table 11-15: BF57 Extraversion Item Correlations with Big Five Dimensions

Scale	Item	O - Openness	C - Conscientiousness	E - Extraversion	A - Agreeableness	N - Neuroticism
E+1.Ada	I am naturally inclined to step forward and lead the group	.30**	.03	.61**	-.35**	-.33**
E+2.Ada	I am naturally lively and expressive	.26**	-.10**	.74**	-.10**	-.13**
E+3.Ada	I am an outgoing and gregarious person	.20**	-.12**	.77**	-.11**	-.16**
E+1.Mal	I have a tendency to take over group discussions	.24**	-.07**	.58**	-.40**	-.05**
E+2.Mal	My high energy levels can overwhelm other people	.29**	-.07**	.60**	-.27**	-.09**
E+3.Mal	I can be too outgoing and talkative	.20**	-.14**	.70**	-.17**	.01
E-1.Ada	I tend to let others do more of the talking in meetings	-.25**	.04*	-.69**	.37**	.20**
E-2.Ada	Others may view me as reserved	-.20**	.11**	-.80**	.17**	.15**
E-3.Ada	I am naturally more quiet and introspective	-.15**	.07**	-.80**	.23**	.17**
E-1.Mal	I take a back seat in group discussions	-.28**	.02	-.67**	.29**	.25**
E-2.Mal	My serious demeanour can be mistaken for a lack of enthusiasm	-.19**	.08**	-.57**	-.06**	.19**
E-3.Mal	I can appear quiet and detached (in social situations)	-.13**	.06**	-.75**	.09**	.18**

*Note: N = 2,506; Scale code first two digits E+ Extraverted, E- Introverted; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).*

Table 11-16: BF57 Agreeableness Item Correlations with Big Five Dimensions

Scale	Item	O - Openness	C - Conscientiousness	E - Extraversion	A - Agreeableness	N - Neuroticism
A+1.Ada	My instinct is to show sensitivity for the feelings of others	-.01	-.04	.01	.58**	.06**
A+2.Ada	I prioritise getting along well with others	-.02	-.04*	.09**	.49**	.02
A+3.Ada	When debating things with others I am careful to avoid causing offence	-.20**	.07**	-.26**	.67**	.09**
A+1.Mal	My empathy for others can cloud my judgement	-.05*	-.15**	-.04*	.50**	.30**
A+3.Mal	I have a tendency to avoid confrontation	-.22**	-.01	-.35**	.63**	.22**
A+3.Mal	I can be too diplomatic and not say what I really think	-.17**	-.06**	-.33**	.63**	.20**
A-1.Ada	I believe arguing my case is more important than worrying about people's feelings	.12**	.02	.12**	-.68**	-.07**
A-2.Ada	I am naturally very competitive with others	.08**	.05*	.25**	-.50**	-.10**
A-3.Ada	I am a tough negotiator and don't give in easily to others	.17**	.07**	.22**	-.58**	-.23**
A-3.Ada	I am firm and direct with others	.15**	.12**	.27**	-.61**	-.21**
A-1.Mal	I can be so focused on the logic of an argument that I hurt people's feelings	.09**	.02	.04*	-.64**	.06**
A-2.Mal	At times I can come across as competitive and egotistical	.18**	-.02	.28**	-.60**	-.02
A-3.Mal	I can be so direct that I upset people	.17**	-.01	.14**	-.70**	.05*

*Note: N = 2,506; Scale code first two digits A+ Agreeable, A- Direct; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).*

Table 11-17: BF57 Neuroticism Item Correlations with Big Five Dimensions

Scale	Item	O - Openness	C - Conscientiousness	E - Extraversion	A - Agreeableness	N - Neuroticism
N+1.Mal	I become stressed easily	-.14**	-.01	-.19**	.16**	.80**
N+2.Mal	I often doubt my abilities	-.19**	-.07**	-.27**	.26**	.71**
N+3.Mal	I am prone to mood swings	-.04	-.09**	-.09**	.00	.71**
N+4.Mal	I am an anxious person	-.16**	.05*	-.25**	.18**	.74**
N-1.Ada	I stay calm in pressure situations	.16**	.05*	.03	-.11**	-.61**
N-2.Ada	I believe in myself and what I can do	.25**	.06**	.26**	-.28**	-.65**
N-3.Ada	I am naturally even-tempered	.01	.02	-.08**	.18**	-.60**
N-4.Ada	Even when things are tough I don't let it get me down	.20**	.00	.19**	-.17**	-.69**

*Note: N = 2,506; Scale code first two digits N+ Neurotic, N- Emotionally Stable; Scale code third digit is the category number; Scale code last three digits Ada – Adaptive, Mal – Maladaptive; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).*

Appendix VI: BF57 Observer Items by Aspect

Table 11-18: BF57 Openness Observer Items

Aspect	Code	Adaptive or Maladaptive	Item	Correlation Self vs 360
Openness Plus	O+1	Adaptive	Their ideas are often unconventional and radical	.31**
Openness Plus	O+2	Adaptive	They are good at thinking outside of the box	.27**
Openness Plus	O+3	Adaptive	They are good at abstract thinking	.39**
Openness Plus	O+1	Maladaptive	Others may consider their ideas as too radical	.24**
Openness Plus	O+2	Maladaptive	Their ideas can be so innovative they may appear unrealistic	.23*
Openness Plus	O+3	Maladaptive	When they present their ideas to others they may come across as too conceptual and complex	.27**
Openness Minus	O-1	Adaptive	They like to do things the conventional way	.28**
Openness Minus	O-2	Adaptive	They stick to proven evidence and rarely think outside the box	.32**
Openness Minus	O-3	Adaptive	Their approach to solving problems is very practical yet may lack a creative spark	.21*
Openness Minus	O-1	Maladaptive	They can find it difficult to be open-minded to more radical ideas	.20*
Openness Minus	O-2	Maladaptive	They can lack the imagination to see wider possibilities	.17
Openness Minus	O-3	Maladaptive	They have difficulty engaging in abstract discussion	.20*

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Code first two digits O+ Open, O- Pragmatic; Code third digit is the category number.*

Table 11-19: BF57 Conscientiousness Observer Items

Aspect	Code	Adaptive or Maladaptive	Rater Item	Correlation Self vs 360
Conscientiousness Plus	C+1	Adaptive	They naturally see things through to completion	.43**
Conscientiousness Plus	C+2	Adaptive	They are a highly organised individual	.45**
Conscientiousness Plus	C+3	Adaptive	They start tasks early to avoid the stress of having to do things at the last minute	.38**
Conscientiousness Plus	C+1	Maladaptive	Their focus on their commitments can make it difficult for them to make spontaneous decisions	.25**
Conscientiousness Plus	C+2	Maladaptive	They can stick too rigidly to a plan	.33**
Conscientiousness Plus	C+3	Maladaptive	They find it difficult to work with those who like to work last-minute	.24*
Conscientiousness Minus	C-1	Adaptive	They are relaxed about time management	.42**
Conscientiousness Minus	C-2	Adaptive	They tend to keep their plans informal in order to keep their options open	.22*
Conscientiousness Minus	C-3	Adaptive	They are more productive working without formal goals	.22*
Conscientiousness Minus	C-1	Maladaptive	They can neglect their commitments and run out of time	.32**
Conscientiousness Minus	C-2	Maladaptive	Their lack of organisation can frustrate others	.52**
Conscientiousness Minus	C-3	Maladaptive	At times they lack a clear goal focus	.20*

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Code first two digits C+ Conscientious, C- Flexible; Code third digit is the category number.*

Table 11-20: BF57 Extraversion Observer Items

Aspect	Code	Adaptive or Maladaptive	Item	Correlation Self vs 360
Extraversion Plus	E+1	Adaptive	They are naturally inclined to step forward and lead the group	.47**
Extraversion Plus	E+2	Adaptive	They are naturally lively and expressive	.46**
Extraversion Plus	E+3	Adaptive	They are an outgoing and gregarious person	.49**
Extraversion Plus	E+1	Maladaptive	They have a tendency to take over group discussions	.39**
Extraversion Plus	E+2	Maladaptive	Their high energy levels can overwhelm other people	.36**
Extraversion Plus	E+3	Maladaptive	They can be too outgoing and talkative	.38**
Extraversion Minus	E-1	Adaptive	They tend to let others do more of the talking in meetings	.33**
Extraversion Minus	E-2	Adaptive	Others may view them as reserved	.44**
Extraversion Minus	E-3	Adaptive	They are naturally more quiet and introspective	.61**
Extraversion Minus	E-1	Maladaptive	They take a back seat in group discussions	.40**
Extraversion Minus	E-2	Maladaptive	Their serious demeanour can be mistaken for a lack of enthusiasm	.26**
Extraversion Minus	E-3	Maladaptive	They can appear quiet and detached (in social situations)	.36**

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Code first two digits E+ Extraverted, E- Introverted; Code third digit is the category number.*

Table 11-21: BF57 Agreeableness Observer Items

Aspect	Code	Adaptive or Maladaptive	Item	Correlation Self vs 360
Agreeableness Plus	A+1	Adaptive	Their instinct is to show sensitivity for the feelings of others	.38**
Agreeableness Plus	A+2	Adaptive	They prioritise getting along well with others	.18
Agreeableness Plus	A+3	Adaptive	When debating things with others they are careful to avoid causing offence	.17
Agreeableness Plus	A+1	Maladaptive	Their empathy for others can cloud their judgement	.17
Agreeableness Plus	A+3	Maladaptive	They have a tendency to avoid confrontation	.34**
Agreeableness Plus	A+3	Maladaptive	They can be too diplomatic and not say what they really think	.28**
Agreeableness Minus	A-1	Adaptive	They believe arguing their case is more important than worrying about people's feelings	.37**
Agreeableness Minus	A-2	Adaptive	They are naturally very competitive with others	.25**
Agreeableness Minus	A-3	Adaptive	They are a tough negotiator and don't give in easily to others	.38**
Agreeableness Minus	A-3	Adaptive	They are firm and direct with others	.29**
Agreeableness Minus	A-1	Maladaptive	They can be so focused on the logic of an argument that they hurt people's feelings	.39**
Agreeableness Minus	A-2	Maladaptive	At times they can come across as competitive and egotistical	.34**
Agreeableness Minus	A-3	Maladaptive	They can be so direct that they upset people	.35**

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Code first two digits A+ Agreeable, A- Direct; Code third digit is the category number.*

Table 11-22: BF57 Neuroticism Observer Items

Aspect	Code	Adaptive or Maladaptive	Item	Correlation Self vs 360
Neuroticism Plus	N+1	Maladaptive	They become stressed easily	.32**
Neuroticism Plus	N+2	Maladaptive	They often doubt their abilities	.25**
Neuroticism Plus	N+3	Maladaptive	They are prone to mood swings	.34**
Neuroticism Plus	N+4	Maladaptive	They are an anxious person	.32**
Neuroticism Minus	N-1	Adaptive	They stay calm in pressure situations	.29**
Neuroticism Minus	N-2	Adaptive	They believe in themselves and what they can do	.36**
Neuroticism Minus	N-3	Adaptive	They are naturally even-tempered	.43**
Neuroticism Minus	N-4	Adaptive	Even when things are tough they don't let it get them down	.27**

*Notes: N = 117; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed). Code first two digits N+ Neurotic, N- Emotionally Stable; Code third digit is the category number.*

Appendix VII: BF57 Big Five Dimensions Correlation Matrix

Table 11-23: Five Dimensions of the BF57 self-correlations matrix

	BF57 O	BF57 C	BF57 E	BF57 A	BF57 N
BF57 O	1.00	-.34**	.32**	-.21**	-.20**
BF57 C	-.34**	1.00	-.10**	-.06**	-.05*
BF57 E	.32**	-.10**	1.00	-.29**	-.22**
BF57 A	-.21**	-.06**	-.29**	1.00	.18**
BF57 N	-.20**	-.05*	-.22**	.18**	1.00

*Notes: N = 2,506; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).*

Appendix VIII: BF57 Eighteen Scales Correlation Matrix

Table 11-24: Eighteen Scales of BF57 Self Correlations Matrix

	O+ Ada	O+ Mal	O- Ada	O- Mal	C+ Ada	C+ Mal	C- Ada	C- Mal
O+ Adaptive	1.00	.64**	-.69**	-.68**	-.15**	-.32**	.29**	.11**
O+ Maladaptive	.64**	1.00	-.46**	-.42**	-.22**	-.15**	.30**	.30**
O- Adaptive	-.69**	-.46**	1.00	.67**	.20**	.45**	-.25**	-.07**
O- Maladaptive	-.68**	-.42**	.67**	1.00	.16**	.43**	-.22**	0.00
C+ Adaptive	-.15**	-.22**	.20**	.16**	1.00	.48**	-.50**	-.67**
C+ Maladaptive	-.32**	-.15**	.45**	.43**	.48**	1.00	-.43**	-.26**
C- Adaptive	.29**	.30**	-.25**	-.22**	-.50**	-.43**	1.00	.52**
C- Maladaptive	.11**	.30**	-.07**	0.00	-.67**	-.26**	.52**	1.00
E+ Adaptive	.28**	.13**	-.32**	-.32**	-0.01	-.25**	.05*	-.05*
E+ Maladaptive	.26**	.31**	-.23**	-.20**	-.06**	-.12**	.10**	.09**
E- Adaptive	-.17**	-.06**	.29**	.26**	.07**	.29**	-0.01	.06**
E- Maladaptive	-.18**	-0.01	.34**	.34**	.05*	.33**	0.01	.13**
A+ Adaptive	-.10**	-.15**	.07**	.05*	0.02	0.03	0.02	0.04
A+ Maladaptive	-.18**	-.06**	.19**	.22**	-.10**	.15**	.09**	.25**
A- Adaptive	.16**	.15**	-.09**	-.11**	.09**	0.00	-.04*	-.12**
A- Maladaptive	.18**	.31**	-.05**	-0.04	0.00	.09**	0.02	.08**
N+ Maladaptive	-.16**	.04*	.20**	.27**	-.11**	.29**	-0.01	.29**
N- Adaptive	.24**	0.03	-.20**	-.27**	.15**	-.22**	.07**	-.23**

Table 11-24 continued

	E+ Ada	E+ Mal	E- Ada	E- Mal	A+ Ada	A+ Mal	A- Ada	A- Mal	N+ Mal	N- Ada
O+ Adaptive	.28**	.26**	-.17**	-.18**	-.10**	-.18**	.16**	.18**	-.16**	.24**
O+ Maladaptive	.13**	.31**	-.06**	-.01	-.15**	-.06**	.15**	.31**	.04*	.03
O- Adaptive	-.32**	-.23**	.29**	.34**	.07**	.19**	-.09**	-.05**	.20**	-.20**
O- Maladaptive	-.32**	-.20**	.26**	.34**	.05*	.22**	-.11**	-.04	.27**	-.27**
C+ Adaptive	-.01	-.06**	.07**	.05*	.02	-.10**	.09**	.00	-.11**	.15**
C+ Maladaptive	-.25**	-.12**	.29**	.33**	.03	.15**	.00	.09**	.29**	-.22**
C- Adaptive	.05*	.10**	-.01	.01	.02	.09**	-.04*	.02	-0.01	.07**
C- Maladaptive	-.05*	.09**	.06**	.13**	.04	.25**	-.12**	.08**	.29**	-.23**
E+ Adaptive	1.00	.63**	-.73**	-.67**	.00	-.26**	.27**	.14**	-.25**	.20**
E+ Maladaptive	.63**	1.00	-.60**	-.47**	-.15**	-.19**	.32**	.40**	-.07**	.03
E- Adaptive	-.73**	-.60**	1.00	.77**	.13**	.36**	-.27**	-.15**	.26**	-.10**
E- Maladaptive	-.67**	-.47**	.77**	1.00	.00	.28**	-.15**	0.03	.31**	-.16**
A+ Adaptive	.00	-.15**	.13**	.00	1.00	.53**	-.49**	-.54**	.12**	-.01
A+ Maladaptive	-.26**	-.19**	.36**	.28**	.53**	1.00	-.50**	-.37**	.35**	-.21**
A- Adaptive	.27**	.32**	-.27**	-.15**	-.49**	-.50**	1.00	.61**	-.16**	.15**
A- Maladaptive	.14**	.40**	-.15**	.03	-.54**	-.37**	.61**	1.00	.03	-.03
N+ Maladaptive	-.25**	-.07**	.26**	.31**	.12**	.35**	-.16**	.03	1.00	-.71**
N- Adaptive	.20**	.03	-.10**	-.16**	-.01	-.21**	.15**	-.03	-.71**	1.00

*Notes: N = 2,506; **. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).*

Appendix IX – BF57 Correlations with IPIP-NEO thirty facets

Table 11-25: Raw Correlations BF57 Eighteen Scales with IPIP-NEO Open to Experience Facets

	O1: IMAGINATION	O2: ARTISTIC INTERESTS	O3: EMOTIONALITY	O4: ADVENTUROUSNESS	O5: INTELLECT	O6: LIBERALISM
O+ Adaptive	.41**	.31**	.10	.50**	.59**	.22**
O+ Maladaptive	.41**	.09	.00	.30**	.39**	.22**
O- Adaptive	-.37**	-.27**	-.21**	-.65**	-.43**	-.33**
O- Maladaptive	-.37**	-.30**	-.21**	-.55**	-.58**	-.25**
C+ Adaptive	-.16*	.00	-.14*	-.27**	-.12	-.22**
C+ Maladaptive	-.23**	-.16*	-.17*	-.58**	-.24**	-.26**
C- Adaptive	.25**	.11	.09	.32**	.20**	.17**
C- Maladaptive	.14*	-.02	.07	.15*	.08	.22**
E+ Adaptive	.09	.05	.25**	.45**	.24**	.06
E+ Maladaptive	.10	-.02	.10	.37**	.19**	.11
E- Adaptive	.02	.06	-.10	-.41**	-.09	-.02
E- Maladaptive	-.01	-.04	-.12	-.40**	-.14*	-.07
A+ Adaptive	.05	.13*	.29**	-.14*	-.03	.03
A+ Maladaptive	.04	.00	.12	-.32**	-.13	.03
A- Adaptive	.03	-.07	-.17*	.07	.07	-.06
A- Maladaptive	.00	-.09	-.11	.16*	.14*	-.21**
N+ Maladaptive	.04	-.06	.15*	-.33**	-.09	-.03
N- Adaptive	.00	.09	-.17**	.31**	.21**	-.01

*Note: Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; N = 234; * p<0.05 ** p<0.01; O1 = Imagination, O2 = Artistic interests, O3 = Emotionality, O4 = Adventurousness, O5 = Intellect, O6 = Liberalism*

Table 11-26: Raw Correlations BF57 Eighteen Scales with IPIP-NEO Conscientiousness Facets

	C1: SELF-EFFICACY	C2: ORDERLINESS	C3: DUTIFULNESS	C4: ACHIEVEMENT-STRIVING	C5: SELF-DISCIPLINE	C6: CAUTIOUSNESS
O+ Adaptive	.12	-.16*	-.25**	.00	-.06	-.11
O+ Maladaptive	-.04	-.25**	-.34**	-.04	-.17**	-.23**
O- Adaptive	-.01	.19**	.24**	.02	.03	.19**
O- Maladaptive	-.07	.17**	.16*	.02	.01	.07
C+ Adaptive	.45**	.53**	.40**	.25**	.50**	.26**
C+ Maladaptive	.09	.30**	.33**	.11	.15*	.26**
C- Adaptive	-.23**	-.37**	-.41**	-.11	-.31**	-.29**
C- Maladaptive	-.44**	-.48**	-.46**	-.19**	-.53**	-.34**
E+ Adaptive	.12	-.15*	-.11	.01	.10	-.23**
E+ Maladaptive	.03	-.20**	-.31**	.03	.00	-.39**
E- Adaptive	-.04	.14*	.15*	.02	-.08	.24**
E- Maladaptive	-.05	.16*	.07	.05	-.11	.14*
A+ Adaptive	-.08	.09	.17*	.01	-.02	.04
A+ Maladaptive	-.26**	.04	.11	-.08	-.12	-.04
A- Adaptive	.02	-.07	-.23**	.02	-.12	-.19**
A- Maladaptive	.28**	-.02	-.08	.12	.11	-.03
N+ Maladaptive	-.30**	-.08	-.12	-.08	-.23**	-.14*
N- Adaptive	.45**	.10	.13*	.19**	.33**	.19**

*Note: Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; N = 234; * p<0.05 ** p<0.01; C1 = Self efficacy, C2 = Orderliness, C3 = Dutifulness, C4 = Achievement striving, C5 = Self-discipline, C6 = Cautiousness*

Table 11-27: Raw Correlations BF57 Eighteen Scales with IPIP-NEO Extraversion Facets

	E1: FRIENDLINESS	E2: GREGARIOUSNESS	E3: ASSERTIVENESS	E4: ACTIVITY LEVEL	E5: EXCITEMENT-SEEKING	E6: CHEERFULNESS
O+ Adaptive	.09	.15*	.20**	-.01	.35**	.17**
O+ Maladaptive	-.05	.06	.12	-.03	.27**	-.02
O- Adaptive	-.31**	-.25**	-.20**	-.06	-.29**	-.28**
O- Maladaptive	-.26**	-.24**	-.22**	.02	-.31**	-.23**
C+ Adaptive	-.08	-.07	.15*	.25**	-.20**	-.03
C+ Maladaptive	-.28**	-.23**	-.08	.03	-.32**	-.22**
C- Adaptive	.12	.09	-.11	-.11	.25**	.08
C- Maladaptive	.06	.06	-.22**	-.16*	.20**	-.03
E+ Adaptive	.60**	.63**	.44**	.20**	.39**	.53**
E+ Maladaptive	.37**	.45**	.37**	.26**	.41**	.33**
E- Adaptive	-.55**	-.54**	-.39**	-.23**	-.28**	-.42**
E- Maladaptive	-.57**	-.54**	-.36**	-.20**	-.25**	-.43**
A+ Adaptive	.20**	.07	-.27**	-.02	-.09	.12
A+ Maladaptive	-.11	-.17**	-.47**	-.08	-.24**	-.11
A- Adaptive	-.06	.06	.33**	.18**	.21**	-.07
A- Maladaptive	.03	.13	.55**	.21**	.33**	.07
N+ Maladaptive	-.31**	-.23**	-.23**	-.10	-.14*	-.43**
N- Adaptive	.18**	.25**	.27**	.22**	.20**	.43**

*Note: Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; N = 234; * p<0.05 ** p<0.01; E1 = Friendliness, E2 = Gregariousness, E3 = Assertiveness, E4 = Activity level, E5 = Excitement seeking, E6 = Cheerfulness*

Table 11-28: Raw Correlations BF57 Eighteen Scales with IPIP-NEO Agreeableness Facets

	A1: TRUST	A2: MORALITY	A3: ALTRUISM	A4: COOPERATION	A5: MODESTY	A6: SYMPATHY
O+ Adaptive	.03	-.12	-.03	-.07	-.33**	.07
O+ Maladaptive	.00	-.23**	-.11	-.23**	-.31**	-.05
O- Adaptive	-.17**	.08	-.09	-.03	.20**	-.10
O- Maladaptive	-.15*	-.02	-.05	-.07	.21**	-.20**
C+ Adaptive	-.09	-.05	-.08	-.10	-.06	-.10
C+ Maladaptive	-.25**	-.09	-.11	-.09	.03	-.17**
C- Adaptive	.18**	-.01	.09	.03	-.05	.17*
C- Maladaptive	.09	-.08	.07	-.02	.01	.01
E+ Adaptive	.22**	-.04	.06	-.07	-.18**	.04
E+ Maladaptive	.13	-.24**	-.10	-.33**	-.27**	-.06
E- Adaptive	-.19**	.06	.00	.13*	.16*	.00
E- Maladaptive	-.23**	.02	-.07	-.02	.14*	-.11
A+ Adaptive	.19**	.22**	.41**	.35**	.30**	.33**
A+ Maladaptive	.13*	.12	.22**	.31**	.27**	.09
A- Adaptive	-.16*	-.36**	-.31**	-.47**	-.24**	-.22**
A- Maladaptive	-.11	-.28**	-.24**	-.44**	-.30**	-.23**
N+ Maladaptive	-.29**	-.15*	.01	-.21**	.18**	.04
N- Adaptive	.20**	.12	-.03	.16*	-.19**	-.03

*Note: Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; N = 234; * p<0.05 ** p<0.01; A1 = Trust, A2 = Morality, A3 = Altruism, A4 = Cooperation, A5 = Modesty, A6 = Sympathy*

Table 11-29: Raw Correlations BF57 Eighteen Scales with IPIP-NEO Neuroticism Facets

	N1: ANXIETY	N2: ANGER	N3: DEPRESSION	N4: SELF-CONSCIOUSNESS	N5: IMMODERATION	N6: VULNERABILITY
O+ Adaptive	-.23**	-.07	-.16*	-.31**	.01	-.24**
O+ Maladaptive	-.08	.06	-.02	-.13*	.09	.00
O- Adaptive	.32**	.13*	.26**	.38**	.00	.25**
O- Maladaptive	.28**	.17*	.22**	.39**	.03	.30**
C+ Adaptive	.19**	.10	.03	.16*	-.17**	.05
C+ Maladaptive	.47**	.20**	.32**	.36**	-.03	.34**
C- Adaptive	-.30**	-.13*	-.09	-.18**	.06	-.15*
C- Maladaptive	-.01	.01	.07	-.03	.28**	.16*
E+ Adaptive	-.24**	-.10	-.29**	-.59**	.02	-.20**
E+ Maladaptive	-.15*	.08	-.12	-.43**	.14*	-.10
E- Adaptive	.25**	.03	.23**	.55**	-.07	.19**
E- Maladaptive	.20**	.07	.28**	.57**	-.04	.15*
A+ Adaptive	.15*	-.12	-.03	-.05	-.02	.21**
A+ Maladaptive	.25**	-.03	.16*	.22**	.02	.36**
A- Adaptive	.06	.29**	.17**	.04	.15*	.02
A- Maladaptive	-.10	.13	-.01	-.11	.07	-.18**
N+ Maladaptive	.70**	.45**	.61**	.44**	.34**	.68**
N- Adaptive	-.55**	-.52**	-.54**	-.31**	-.31**	-.66**

*Note: Absolute correlations between 0.3 & 0.4 shaded light grey; Absolute correlations >0.4 shaded dark grey; N = 234; * p<0.05 ** p<0.01; N1 = Anxiety, N2 = Anger, N3 = Depression, N4 = Self-consciousness, N5 = Immoderation, N6 = Vulnerability*

Appendix X – TDA Expected & Actual Adjective Level Factor Loadings

Table 11-30: Actual Adjective Loadings on Extraversion

Number 1 to 100	Adjective	Expected Highest Factor	Actual Highest Factor	Second highest factor the expected highest factor	Factor 1 - Extraversion	Factor 2 - Conscientiousness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Openness
1	Extraverted	E+	E+		0.82	-0.10	0.18	-0.04	0.05
2	Talkative	E+	E+		0.67	-0.01	0.25	0.16	0.09
3	Assertive	E+	E+		0.56	0.29	-0.11	-0.05	0.16
4	Verbal	E+	E+		0.55	0.02	0.28	0.10	0.18
5	Vigorous	E+	E+		0.51	0.20	0.03	0.02	0.15
6	Energetic	E+	E+		0.48	0.21	0.12	0.00	0.10
7	Bold	E+	E+		0.46	0.02	-0.10	0.01	0.35
8	Daring	E+	E+		0.45	0.00	-0.08	-0.01	0.38
9	Unrestrained	E+	E+		0.41	-0.17	-0.03	-0.01	0.18
10	Active	E+	E+		0.38	0.21	0.18	-0.03	0.04
11	Unsophisticated	O-	E-	No	-0.24	-0.23	-0.13	0.06	-0.20
12	Undemanding	N-	E-	Yes	-0.31	-0.18	0.27	-0.30	-0.13
13	Unadventurous	O-	E-	Yes	-0.37	-0.03	-0.07	0.16	-0.36
14	Introspective	O+	E-	Yes	-0.41	0.07	0.04	0.24	0.25
15	Unexcitable	E-	E-		-0.42	0.07	-0.30	-0.21	-0.13
16	Bashful	E-	E-		-0.51	-0.04	-0.07	0.30	-0.02
17	Inhibited	E-	E-		-0.52	0.06	-0.12	0.17	-0.15
18	Timid	E-	E-		-0.60	-0.04	0.00	0.23	-0.09
19	Withdrawn	E-	E-		-0.62	-0.06	-0.28	0.27	-0.02
20	Reserved	E-	E-		-0.64	0.23	-0.22	0.12	0.02
21	Shy	E-	E-		-0.66	0.07	-0.05	0.24	-0.06
22	Untalkative	E-	E-		-0.70	0.00	-0.28	0.04	0.01
23	Introverted	E-	E-		-0.74	0.13	-0.19	0.15	0.14
24	Quiet	E-	E-		-0.75	0.19	-0.12	0.01	0.12

Note: N = 420.

Table 11-31: Actual Adjective Loadings on Conscientiousness

Number 1 to 100	Adjective	Expected Highest Factor	Actual Highest Factor	Second highest factor the expected highest factor	Factor 1 - Extraversion	Factor 2 - Conscientiousness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Openness
25	Organized	C+	C+		0.01	0.74	0.11	0.08	0.05
26	Efficient	C+	C+		0.03	0.72	0.05	0.07	0.18
27	Thorough	C+	C+		-0.10	0.69	0.09	0.07	0.20
28	Systematic	C+	C+		-0.17	0.66	-0.10	0.08	0.01
29	Neat	C+	C+		0.06	0.63	0.18	0.13	0.01
30	Prompt	C+	C+		0.08	0.52	0.07	-0.07	0.04
31	Steady	C+	C+		-0.10	0.51	0.08	-0.21	-0.06
32	Conscientious	C+	C+		0.02	0.48	0.18	0.00	0.04
33	Careful	C+	C+		-0.33	0.46	0.12	0.20	-0.14
34	Practical	C+	C+		0.05	0.43	0.09	0.07	-0.10
35	Undependable	C-	C-		0.06	-0.36	-0.06	0.10	-0.10
36	Impractical	C-	C-		-0.05	-0.48	-0.07	0.09	0.15
37	Negligent	C-	C-		0.03	-0.49	-0.23	0.23	-0.07
38	Inconsistent	C-	C-		0.03	-0.52	-0.08	0.28	-0.02
39	Careless	C-	C-		-0.05	-0.59	-0.10	0.17	-0.11
40	Inefficient	C-	C-		-0.11	-0.60	0.01	0.16	-0.11
41	Sloppy	C-	C-		-0.08	-0.63	-0.07	0.18	-0.11
42	Haphazard	C-	C-		0.11	-0.64	-0.03	0.25	-0.03
43	Disorganized	C-	C-		-0.10	-0.71	-0.04	0.05	0.04
44	Unsystematic	C-	C-		0.06	-0.72	-0.02	0.05	-0.08

Note: N = 420.

Table 11-32: Actual Adjective Loadings on Agreeableness

Number 1 to 100	Adjective	Expected Highest Factor	Actual Highest Factor	Second highest factor the expected highest factor	Factor 1 - Extraversion	Factor 2 - Conscientiousness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Openness
45	Kind	A+	A+		0.09	0.14	0.70	-0.02	0.13
46	Warm	A+	A+		0.23	0.02	0.68	0.10	0.07
47	Sympathetic	A+	A+		0.02	0.02	0.67	0.07	0.08
48	Cooperative	A+	A+		0.05	0.25	0.57	-0.03	0.10
49	Considerate	A+	A+		0.06	0.27	0.56	-0.05	0.19
50	Generous	A+	A+		0.19	0.14	0.56	0.07	0.18
51	Helpful	A+	A+		0.10	0.28	0.55	0.00	0.10
52	Pleasant	A+	A+		0.07	0.08	0.52	-0.02	0.06
53	Agreeable	A+	A+		-0.10	0.07	0.48	-0.06	-0.07
54	Trustful	A+	A+		0.12	0.22	0.29	-0.04	-0.13
55	Shallow	N+	A-	No	-0.08	-0.29	-0.30	0.27	-0.23
56	Distrustful	N+	A-	Yes	-0.21	-0.03	-0.35	0.22	-0.02
57	Demanding	A-	A-		0.36	0.20	-0.37	0.33	0.17
58	Selfish	A-	A-		-0.04	-0.23	-0.43	0.35	0.01
59	Uncooperative	A-	A-		-0.09	-0.18	-0.43	0.26	-0.18
60	Rude	A-	A-		0.05	-0.28	-0.49	0.42	-0.04
61	Uncharitable	A-	A-		-0.17	-0.10	-0.51	0.14	-0.17
62	Unemotional	A-	A-		-0.31	0.12	-0.53	-0.25	-0.11
63	Harsh	A-	A-		0.09	0.10	-0.53	0.42	0.04
64	Unsympathetic	A-	A-		-0.08	-0.06	-0.61	0.15	-0.11
65	Unkind	A-	A-		-0.16	-0.16	-0.63	0.12	-0.15
66	Cold	A-	A-		-0.21	0.03	-0.65	0.12	-0.03

Note: N = 420.

Table 11-33: Actual Adjective Loadings on Neuroticism

Number 1 to 100	Adjective	Expected Highest Factor	Actual Highest Factor	Second highest factor the expected highest factor	Factor 1 - Extraversion	Factor 2 - Conscientiousness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Openness
67	High Strung	N+	N+		0.09	-0.05	-0.14	0.70	0.06
68	Anxious	N+	N+		-0.33	-0.04	0.04	0.67	0.04
69	Jealous	N+	N+		-0.08	-0.03	-0.02	0.65	-0.04
70	Temperamental	N+	N+		0.09	-0.13	-0.16	0.63	0.10
71	Moody	N+	N+		-0.21	-0.11	-0.16	0.63	0.10
72	Fretful	N+	N+		-0.29	-0.09	0.02	0.62	-0.01
73	Nervous	N+	N+		-0.44	-0.13	0.04	0.60	-0.05
74	Irritable	N+	N+		-0.10	-0.05	-0.32	0.58	-0.01
75	Touchy	N+	N+		0.03	-0.02	0.07	0.57	-0.01
76	Envious	N+	N+		-0.12	-0.04	-0.02	0.57	-0.07
77	Self Pitying	N+	N+		-0.24	-0.14	-0.09	0.56	-0.12
78	Fearful	N+	N+		-0.42	-0.03	0.09	0.56	-0.21
79	Insecure	N+	N+		-0.37	-0.08	0.02	0.53	-0.16
80	Emotional	N+	N+		0.11	-0.13	0.44	0.49	0.14
81	Imperturbable	N-	N-		-0.15	0.02	-0.07	-0.40	0.03
82	Unenvious	N-	N-		-0.01	0.08	0.09	-0.43	0.02
83	Relaxed	N-	N-		0.12	0.01	0.20	-0.51	0.10

Note: N = 420.

Table 11-34: Actual Adjective Loadings on Openness

Number 1 to 100	Adjective	Expected Highest Factor	Actual Highest Factor	Second highest factor the expected highest factor	Factor 1 - Extraversion	Factor 2 - Conscientiousness	Factor 3 - Agreeableness	Factor 4 - Neuroticism	Factor 5 - Openness
84	Creative	O+	O+		0.09	-0.05	0.14	-0.05	0.79
85	Imaginative	O+	O+		0.14	-0.02	0.18	-0.01	0.72
86	Innovative	O+	O+		0.21	0.00	0.02	-0.12	0.68
87	Artistic	O+	O+		0.00	-0.05	0.12	0.06	0.61
88	Complex	O+	O+		-0.17	0.03	-0.15	0.31	0.49
89	Deep	O+	O+		-0.12	0.09	0.22	0.14	0.48
90	Intellectual	O+	O+		0.11	0.22	-0.08	0.01	0.45
91	Philosophical	O+	O+		-0.09	-0.04	0.13	-0.07	0.45
92	Bright	O+	O+		0.22	0.23	0.01	-0.03	0.38
93	Simple	O-	O-		-0.11	0.10	0.06	-0.08	-0.22
94	Imperceptive	O-	O-		-0.14	-0.18	-0.14	0.07	-0.31
95	Unintelligent	O-	O-		-0.11	-0.19	-0.15	-0.02	-0.31
96	Uninquisitive	O-	O-		-0.16	-0.08	-0.02	0.12	-0.33
97	Unreflective	O-	O-		0.12	-0.17	-0.21	0.10	-0.42
98	Unintellectual	O-	O-		-0.06	-0.27	-0.01	0.02	-0.46
99	Unimaginative	O-	O-		-0.18	0.05	-0.16	0.08	-0.73
100	Uncreative	O-	O-		-0.08	0.07	-0.17	0.05	-0.75

Note: N = 420.